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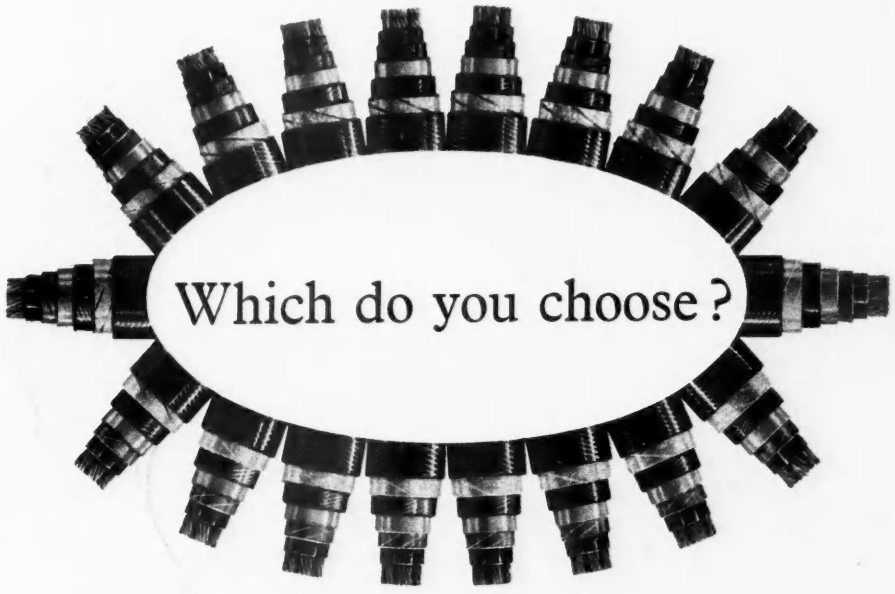

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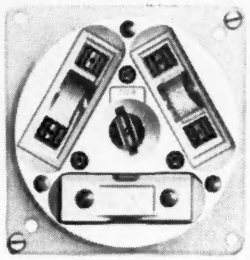

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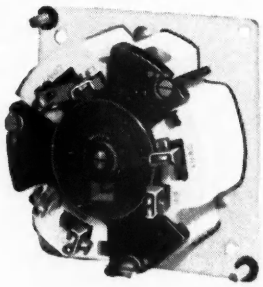

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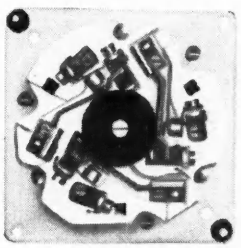

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ELECTRICAL REVIEW

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20 APRIL 1956

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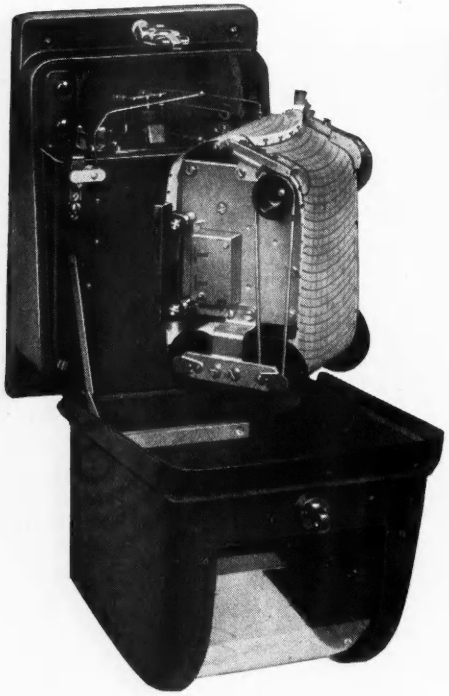

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ELECTRICAL REVIEW

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Export and Exhibitions

WHEN British Industries Fair, Ltd., was formed in 1954 it was thought that the future of the Fair had been settled for at least three or four years, but the Government's abrupt decision to end the London section after this year's display (23rd April to 4th May) has caused a great deal of re-thinking. If it had also ended the Birmingham Section the matter would have been settled—very unsatisfactorily, but still settled. But it was not in the Government's power to suddenly put a stop to an enterprise which it supported but did not control. Although the Birmingham section will be seriously affected by the loss of the Government-sponsored overseas publicity for the Fair it is still to be carried on by the Birmingham Chamber of Commerce.

The Electrical Section at Birmingham had diminished year by year until the *coup de grace* was administered by the decision of many of the electrical exhibitors to move their displays to London. Sufficient of them had done this to make up a fairly representative electrical element and it was the hope of the organisers that this substantial nucleus would attract further exhibitors to future Fairs.

One formidable obstacle to the fulfilment of this hope has been the Electrical Engineers' Exhibition which has absorbed the energies and exhibition funds of many concerns, and apparently they have been satisfied with the results. It cannot be doubted that this exhibition has been successful: its rapid growth is evidence of its success. There have been a number of overseas visitors to this exhibition but whether they have come in sufficient numbers to realise the aim of the organisers to cater for export trade is questionable. Unless the exhibition does this it is not a satisfactory substitute for the Electrical Section of the B.I.F., although it must be admitted that the B.I.F. has itself not been entirely satisfactory in this respect.

With only Birmingham left as an alternative what should be the attitude of electrical manufacturers who attach importance (as they should) to export trade? Those who transferred to London, because of the comparative inaccessibility of Birmingham, may hesitate to retrace their steps; but if they believe in the B.I.F. they should have no compunction about returning to Castle Bromwich.

The alternative stimulus to export trade offered by the Government is financial support for British exhibits at foreign fairs. But unless very substantial sums are offered this aid will be spread rather thinly over many industries in many fairs. It is possible, too, that only the largest concerns will feel able to participate in these overseas

exhibitions. One of the advantages of the British Industries Fair has been that comparatively small firms could obtain space at reasonable rates and they were not involved in the difficulties attendant upon the arrangement of displays overseas.

It will be seen that a choice is given of either bringing overseas customers to Great Britain or showing our goods to them in their own countries. Both methods should be employed and the Government should not be sparing in its encouragement. There are many other ways of economising: anything which is likely to increase export trade should not be abandoned.

The last word lies with those who have to find the money for exhibits in this country and overseas. Having stated the position as we see it, we invite them to express their views in our pages.

DIGITAL COMPUTER TECHNIQUES

The convention on digital computer techniques which was held at the Institution of Electrical Engineers in London last week was very successful and the technical sessions were well attended. This was probably due to the fact that in addition to the specialist sessions in which experts described and discussed detailed advances there were also a similar number of general sessions during which papers covering a very wide field were read. Despite the obvious interest shown by those who attended the convention there is a general lack of knowledge of the capabilities of electronic high-speed digital computers and their potential value to both commerce and industry. Furthermore, the computer experts themselves do not seem to be fully conversant with all the types of problems which require solution.

This state of affairs will undoubtedly right itself in due course but only if there is a more active liaison between computer designers and users and, more important still, potential users. As was pointed out in the recent annual report of the National Research Development Corporation, there is no systematic training in this field. The Corporation continues to make grants to Manchester and Cambridge Universities for the training of computer engineers, but the response is disappointingly small. We can only hope that the convention will do something towards increasing general interest in what is one of the most important developments of our time.

RAILWAY PROGRESS

British Railways have been required to cut their 1956 capital investment by £12 million but this, says the British Transport Commission, will not affect the major works of the £1,200 million modernisation plan. Probably the most important development this year will be the starting of work on the electrification of the Manchester-Crewe section. This has been described as the first step in main-line electrification, although in the Southern Region there are already some long stretches (on the d.c. third rail system) and these will be extended by continuing the electrified sections in Kent down to the coast. The Shenfield-Chelmsford electrification is to be completed in June and the extension to Southend early next year. It is also proposed to begin work this year on the electrification of the Eastern Region suburban lines out of Liverpool Street—a badly needed improvement.

At the same time British Railways are spending £23 million on multiple-unit diesel trains and £26 million on other passenger rolling stock, including electric vehicles. It is expected that the delivery of the main-line diesel and diesel-electric locomotives ordered last year (*Electrical Review*, 2nd December) will commence in 1957.

HEADS IN THE SAND

The Ministry of Fuel and Power has ruled that the gas and electricity supply industries must not "knock" each other; they are both nationalised and on this account some zealots would think that they should not be seen to be in competition. But the competition is an inescapable fact and only the Ministry really believes that it is possible to avoid comparisons, some of which may be odious. The latest manifestation of this ruling is a request from the British Electrical Development Association that an extensive part of one of the papers read at its last week's annual conference shall not be published.

The excised section gave a comparison of electricity, gas and solid fuel mainly on a cost basis. Except that it placed electricity in a more favourable light than its opponents do, there was nothing in it very derogatory to electricity's rivals. Surely the industry should be allowed to reply to the open and clandestine campaign against it on the score of expense. Or would the Minister consider it a wicked animal because it defends itself when attacked?

RESEARCH EXPENDITURE

Some figures which we saw recently showed the amounts spent on research by the major industries in this country and the United States. The aircraft industry headed the list and the figures were comparable for the two countries. The electrical industry came next with £20 million annually in this country and £320 million in America, which, even allowing for the disparity in populations, represents a staggering difference. Despite the comparison the research expenditure by our own industry is high and constantly increasing, and it serves to keep the products of electrical engineering as one of the major export groups of this country. In chemicals, also one of the leading export groups, an amount of £15 million is spent annually on research. A constant stream of new and varied ideas, based on research, ensures that our electrical goods will always be in demand. For example, even in long-established spheres such as electric traction, the development of germanium rectifiers, a product of pure research, may yet have a radical influence on the economics.

It is all the more surprising that in our major exporting industry, automobiles, only about £3 million annually is spent on research and the number of science graduates recruited is very few. This may well help to explain the fall in the power of that industry to attract new customers and it serves to emphasise how vital research expenditure is at the present time.

Nuclear Energy Materials

Unorthodox Techniques of Manufacture and Treatment

By H. M. FINNISTON,
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Head of Metallurgy Division,
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IN the public mind—both lay and those not technically versed in the " mysteries " of atomic energy—there is a tendency to consider the future development of nuclear energy based on fission processes in the main as a field of excercise for specialist physicists; those who have to put this new power to work—and economically at that—have no such illusion. They recognise that the major problems on whose solution further progress depends, are problems of materials and processes and the province of the chemist, the chemical engineer and the metallurgist. This situation is not unique to atomic energy since all modern technologies in greater or lesser degree depend increasingly for their advance on the materials at their disposal; but what is peculiar to atomic energy is that for various reasons it demands several new materials to withstand conditions of service not previously met with.

Examples of the new materials of the atomic world are fissionable elements like uranium and plutonium; thorium which can be converted by nuclear processes into fissionable uranium; and zirconium, beryllium and niobium which, because of some favourable combination of properties, e.g., good nuclear characteristics and satisfactory corrosion resistance in certain coolants, make them acceptable as canning or structural materials. A condition of service which has not had to be faced before in any technology, is that these materials have to tolerate continuous bombardment of their crystalline structure by fission products, neutrons or other radiation. Each of these materials whether as metals, alloys or inorganic compounds has its own physical and chemical peculiarities which condition the extraction techniques used for winning them, the fabrication methods for shaping them and, in the case of metals, the alloying and treatment which improve them for service. This short account describes some features entailed in the provision of several of the special materials of atomic energy.

Uranium

Nuclear reactors operate only when a certain critical mass of a fissionable element is arranged in an appropriate assembly (the reactor core). There are two such elements —uranium and plutonium. Fissionable uranium can be either the isotope U235 or U233. The former occurs in nature mixed with 139 times its weight of U238*; the latter is formed in thorium by nuclear reaction. U235 is separable from U238 by physical processes, e.g. diffusion through a membrane, but not chemically since both uranium isotopes behave identically in this respect. U233 can be chemically separated from thorium however since it is a distinctively different element.

It is a fortunate circumstance for man that natural uranium with its normal content of 0·7 per cent of U235 can be used directly in certain types of thermal reactors, provided proper choice is made of moderator, coolant and structural materials of the core and careful attention paid to the nuclear purity of the core materials. The Calder Hall graphite moderated, gas cooled (carbon dioxide) reactor, and the heavy water moderated, light water cooled reactor at Chalk River, Canada, are two widely different examples of reactors, which use natural uranium as fuel.

One of the first problems of the supply of uranium lies in its extraction from its ores. These vary in mineralogical form and in their content of uranium, ranging from about 0·3 per cent of uranium as U3O8 in comparatively rich deposits such as those of Canada or the Belgian Congo to about 0·1 per cent in such low grade sources as the South African gold wastes, the alum shales of Sweden or the phosphate rocks of Florida.

The process details for extracting uranium from these dissimilar sources naturally differ. Few ores permit significant physical beneficiation. All are leached either in acid, generally sulphuric acid, or in alkaline solutions, e.g., mixed sodium carbonate and bicarbonate; acid leaching is the more widely used. The recovery of uranium from the digested liquor can be achieved by conventional chemical precipitation, but two developments which depart from conventional practice are interesting because of their increasing application in chemical processing in atomic energy in general and to metal extraction in particular. The first of these is the use of ion exchange resins which selectively absorb specific ions from solutions passing over them, thus effecting both concentration and purification. After elution of the resin the concentrated uranium-bearing solution may be treated by chemical means to yield the purified oxide. The second method, not as yet widely practised for uranium winning, is that of solvent extraction. Here the uranium and other dissolved constituents of the leach solution are mixed with a water insoluble organic solvent either in columns or mixer-settlers in which the aqueous and organic components move in counter current. The selective action of the organic solvent (for reasons different from those applying to the resin) again effects a separation and concentration of the uranium from some of the unwanted impurities. The wide choice of organic solvents and adjustments of the aqueous phase, e.g., specificity of the uranium ion, complexity of the salt in solution, pH, etc., provide flexibility in operation and afford a wide field of application (see later). Natural uranium for nuclear reactors has to be free from impurities which absorb neutrons, e.g., boron and cadmium, the acceptable levels of impurity being restricted in some cases to less than one part per million. This may involve further refined chemical treatment of the product from the concentrated leach solutions before the product is ready for reduction to metal.

The " classical " method for making uranium metal is by reduction of its fluoride (UF_4) with calcium or magnesium. On economic grounds the latter is preferred. The problems here are to ensure no pickup of impurities (thus undoing either the earlier purification stages or rendering the metal unfit for later fabrication) and to achieve high efficiencies of metal recovery in a form suitable for further processing. This has meant careful attention to fluorination of the

* This isotope is fissionable in special circumstances; it is important primarily because it constitutes the raw material from which fissile plutonium is formed.

oxide, provision of a supply of high purity distilled calcium or magnesium, development of techniques for manufacture of special high purity ceramics, e.g., calcium fluoride or electro-fused dolomite as linings for the vessels in which actual reduction is carried out, and determination of the optimum conditions—vessel design, initiation of reaction, atmosphere, slag control, etc.—in which to effect reduction. The metal from the fluoride route is obtained as massive billets.

Uranium metal is chemically extremely reactive, burning in air at temperatures about 400 deg C when in massive form. Hence if casting is adopted, either as an intermediate or final fabrication stage, melting must be done in an inert atmosphere or purified argon or helium or in vacuum. Induction furnaces capable of melting up to 500 lb in a single charge in a vacuum of less than a micron before casting are now in common use. Uranium reacts with most metallic and many non-metallic materials when liquid. Crucibles are generally of graphite, which although not inert to uranium reacts at a rate which results in restricted pick-up of carbon (approx. 500 ppm.)—a tolerable impurity from both the nuclear aspect and metallurgically. Uranium metal can be cast in a variety of moulds—graphite, steel, copper, etc. If metallic moulds are used they require to be coated with a ceramic or graphite to prevent interaction between the molten metal and the mould. The development of casting techniques now allows precision casting of bars of uranium to ±0·003in on diameters from ½in upwards and of manufacture of complex shapes.

Uranium has three allotropic modifications between room temperature and the melting point (1,133 deg C). The alpha (or thorhombic) phase exists up to 660 deg C, the beta (tetragonal) phase between 660 deg C and 775 deg C, and the gamma (cubic) phase from 775 deg C to the melting point. The metal can be rolled, extruded, swaged or cold worked at appropriate temperatures. Prevention of oxidation and reaction with container materials are problems of high temperature working. Rolling is best done in the alpha range between 450 deg and 650 deg C. The beta form is comparatively brittle and does not work easily, although it is possible by prior working in the alpha range to effect some further reduction in the beta range. Gamma uranium is far too soft to roll satisfactorily. Extrusion is carried out at much higher temperatures than for rolling, but a further problem here is that of die materials, since at 800 deg C, reaction with the metallic binders of ceramic dies (e.g. WC, TiC or TaC bonded with nickel or cobalt) leads to seizure and galling. Swaging can be done cold or warm (300 deg-400 deg C). Cold drawing of wire or rolling of strip presents no major difficulty, provided the metal is not embrittled by impurities which tend to segregate at grain boundaries. Machining of uranium is done wet with standard tool steels or carbide tools; if machined dry, uranium swarf fires.

In the present stage of nuclear power development the basic properties required of a fuel element to resist irradiation damage under a wide variety of conditions, but particularly of temperature, are not fully known. Any technique therefore which allows of fabrication of fuels with special properties may be specially useful to future reactors development. One such alternative is the use of uranium powder from which, for example, one can make a porous fuel, or special mixtures of uranium and a second element, which cannot be alloyed by more conventional fabrication practice.

Uranium powder can be made by direct reduction of the oxide with calcium or magnesium or by electrolysis of a fused salt, either a fluoride or a chloride. The powders from both these methods differ in form, the oxide route yielding a spherical powder, and the electrolytic route dendritic particles. Because of the increased surface-volume ratio, the reactivity of uranium powder is much increased by comparison with massive uranium and special precautions have to be taken in handling the dry powder. By coating each particle with wax it is possible to reduce pyrophoricity, the wax providing a protective skin during storage and a protective atmosphere during subsequent test fabrication. Uranium powder can be processed by any of the fabrication methods already detailed for massive metal; in addition it can be fabricated by methods peculiar to metal powders, viz., sintering (in vacuo or inert atmosphere) or hot pressing. Controlled porosities and densities up to theoretical can be achieved.

Uranium when worked in the alpha range (cold or hot) develops a preferred orientation of its grain structure, and this is a great disadvantage on subsequent irradiation of the metal at temperatures below 400 deg C. Uranium of large grain size also shows considerable wrinkling or " orange peeling " of the surface when irradiated within the same temperature range. It is possible to eliminate the unwanted orientation and at the same time achieve a fine grain size by heating the metal to within the beta range and quenching in a suitable medium—water or oil. The process is fairly critical, since too high a temperature or too long a time in the beta range may give a large grain structure which is reflected in poor refinement on quenching. By the addition of small amounts (up to 1 per cent) of specific alloying elements of acceptable nuclear characteristics it is possible, with isothermal heat treatment, to control more closely the grain size and structure. Alloy segregation, size effects, and the interference of other impurities on treatment schedules have still to be established on a wide technological front. Because of the anisotropy of alpha uranium, heat treatment and, in fact, all hot working operations may lead to warping. This can be corrected by a stress relieving treatment within the alpha range, although care has to be taken in this operation, if the final condition is to be no worse than the original.

Enrichment of Uranium

The use of natural uranium is a restriction on the types of reactor design. Greater flexibility is afforded to the designer in choice of materials to overcome the problems of irradiation damage in coolants, in sheathing to achieve higher ratings, reducing corrosion or easing of engineering problems, and structural metals which make up the core of the reactor, if he can use fuels more concentrated in fissile content. This can be done either by enriching natural uranium in a diffusion plant or by spiking the fuel matrix or body with uranium 233, uranium 235 or plutonium. Spiking in this sense means the independent addition of these fissile elements from an external source to the matrix of the fuel, which can be either natural or depleted uranium, alloyed uranium or even a non-fissile material which does not parasitically absorb neutrons excessively, e.g. zirconium, thorium or aluminium.†

The enrichment of uranium by diffusion requires the preparation of a volatile compound of uranium which in its passage through a porous membrane allows the separation of those molecules containing uranium 235 from those with uranium 238. The compound which has been found most satisfactory is uranium hexafluoride, UF_6, which boils at about 56 deg C. The manufacture of a membrane with such fine porosity as not to allow bulk diffusion of gas, or block up as a result of corrosion, and which has sufficient strength to withstand the differences in pressure across it, is in itself a considerable technological

† The term spiking is best appreciated if one looks upon natural uranium as uranium 238 (non-fissile) spiked with 0·7 per cent uranium 235.

achievement. The whole of the system—pipework, pumps, etc.—has to be made in materials which do not leak. For pipework, this has demanded a high degree of welding skill and a standard much higher than that which would normally be acceptable in industrial plants. The constructional materials, too, must be such that they do not absorb or react with the uranium compound, particularly after separation.

It is one of the unusual features of the use of pure, fissile or highly enriched materials that in their processing one is restricted to the size of batch with which one can operate. This is because a critical mass is critical whether it is put together by accident or design. One is therefore compelled to design the plants processing highly enriched uranium in such a way that at no stage and at no time can more than a certain and sub-critical amount of the material be in the vicinity of a particular part of the plant.

Uranium which has been put through a diffusion plant can be separated into a number of fractions of varying uranium 235 concentration, and reactors can be designed to take either very highly enriched materials or uranium enriched only slightly above the normal content of 0·7 per cent. The enriched uranium or the pure fissile material can be added to the fuel during melting or by powder metallurgy techniques to give the desired concentration. If the latter, the uranium can be added as metal powder or as a ceramic, e.g., UO_2.

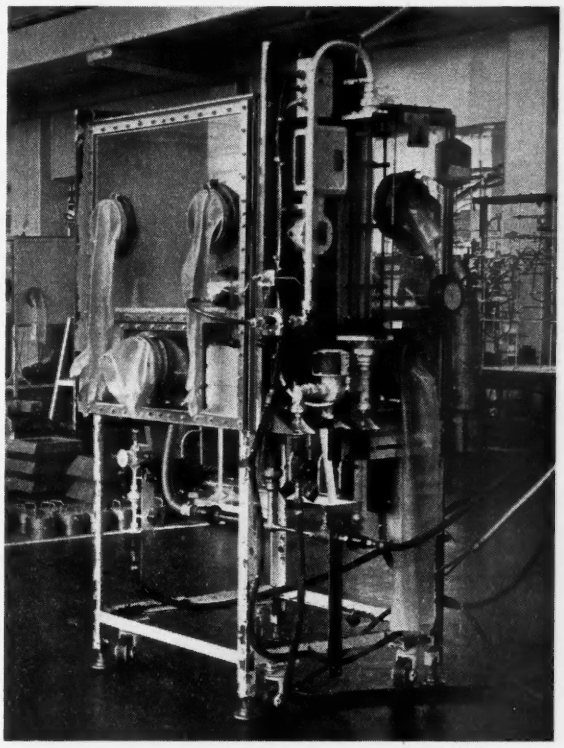
The manufacture of enriched uranium is an expensive operation and for this reason all stages of processing and handling enriched uranium have to be most carefully designed to avoid losses, or if this is not possible to ensure the highest recoveries. Enriched uranium has, of course, the same properties as natural uranium, both chemically and physically.

Plutonium

The element plutonium is made in a nuclear reactor by reaction between uranium 238 and a thermal neutron. Plutonium is separated from irradiated uranium in a chemical plant and can be manufactured into metal by thermal reduction methods comparable with those used for uranium. An earlier reference has already been made to the ubiquity of solvent extraction methods for the purification and concentration of leached ore solutions. The separation of uranium from plutonium and the fission products formed on irradiation is a particularly good example of the application of this technique to an entirely different stage of nuclear technology.

Plutonium is alpha active and if ingested or inhaled will cause severe biological damage to tissue immediately surrounding the plutonium deposit in the body. The permissible amount of plutonium which one can ingest in a lifetime is about $0{\cdot}5 \times 10^{-6}$ gram; the amount which can be tolerated as airborne or surface contamination is less than this. All operations with plutonium, therefore, are done in sealed boxes, which are maintained at a negative pressure so that leakage is not into the room or shop. The extract from the boxes goes through a filtering system to catch any plutonium dust, etc. The metal is handled through ports in the boxes into which rubber gloves are inserted.

Plutonium is so chemically active that operations with it are carried out either in an inert gas atmosphere (argon or helium) purified, so that it contains few parts per million of oxygen and nitrogen, or in very high vacuum. With very dry atmospheres, higher concentrations of oxygen (and nitrogen) can be tolerated. In the handling of plutonium one has always to design with the problem in mind of having to work with restricted masses because of criticality considerations.



Plutonium is handled through ports in the boxes into which rubber gloves are inserted

Plutonium itself is probably the most complex of all metals known to man. Examples of its complexity may be gauged from the following. Although it melts at 640 deg C it exists in at least six different forms between room temperature and its melting point; in changing from one phase to another density changes up to 20 per cent occur and one of the phases though cubic contracts on heating. Some of the phases are brittle and others ductile, but plutonium can be cast, rolled, extruded and swaged; powder metallurgy techniques can also be applied.

Plutonium itself will never be used as a pure metal in reactors. For thermal reactors, concentrations in suitable matrices of only 1 to 2 per cent of plutonium are sufficient to keep a reactor going (cf. 0·7 per cent U235 in natural uranium); in fast reactors about 20 to 40 per cent of plutonium alloyed or dispersed in a base metal is necessary. Techniques for mixing or alloying the plutonium in these concentrations with either uranium or such metals as zirconium, thorium and a wide variety of other acceptable nuclear materials and fabricating these alloys in glove boxes have been developed in the laboratory stage. As plutonium becomes more available for civil use, these techniques will require translation to full scale production. The complications of dry boxing and of inert atmosphere all put up fabrication costs and introduce new problems of handling and manufacture.

Thorium

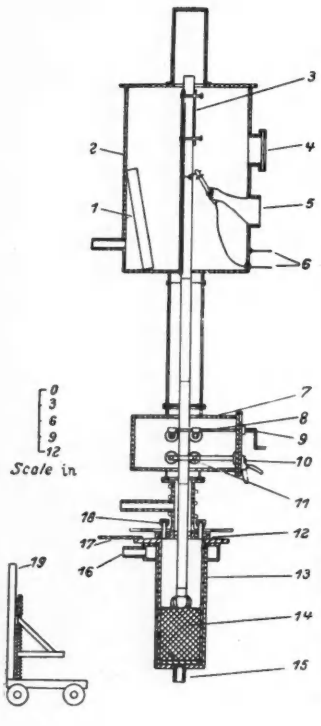
Thorium is present in nature in as great profusion as uranium. Its importance in reactor developments to date has not been considerable, but because of its good nuclear characteristics and as a source of the fissile material uranium 233 it is beginning to assume an increasingly important role in future designs of more advanced reactors. Its superior metallurgical characteristics compared with uranium derive

mainly from the simplicity of its crystal structure and the existence of a second phase outside its service range of temperature. In separating thorium from its ores one is faced with much the same problems as with uranium, and many of the techniques for the extraction of uranium from its ores have their comparable stages with thorium processing. Thorium can be made either in billet form by a modified fluoride reduction technique involving boosters (chemicals added to provide extra heat of reaction) or as metal powders by calcium reduction of the oxide. The oxide cannot be reduced with magnesium. Metal powder can also be made by electrolysis of a fused salt bath carrying either a chloride or fluoride of thorium.

Thorium has a very high melting point (1,830 deg C) and is easily oxidised. It is possible to vacuum melt thorium in much the same way as uranium, except that all containment problems are aggravated because of the higher melting point and high chemical reactivity of the metal. The most elegant method for melting thorium is to use the technique of arc melting which has been considerably improved over the past few years for the melting of refractory metals. In this method a water cooled metal crucible which does not introduce contaminants into the thorium is used. An arc is struck in an atmosphere of purified argon or helium between the metal to be melted (thorium in this case) and an electrode made either of this same material (consumable electrode) or of a water cooled rod with tungsten (non-consumable electrode). If the latter is used, powder is passed between the tungsten electrode and the base on which the ingot is to be built up either by raising the electrode or lowering the base. If the electrode is consumable, a rough consolidation either by rolling or extrusion of the metal has first to be carried out. The individual lengths are joined and fed into the arc zone.

Thorium is easily extruded and powder metallurgy techniques, particularly cold pressing and sintering, are simple to apply. The metal can be cold worked without difficulty. Thorium is not generally heat treated except after cold working, although in some of the new alloys which are being developed to give improved creep resistance or corrosion resistance such heat treatment may be desirable. Thorium metal has comparatively low strength.

The materials so far dealt with are of unique importance to atomic energy either because no reactor could work without them or because they provide a source of fresh fissile material. The metals now to be discussed are important because of their engineering properties.



Typical arc furnace for melting thorium

1. Electrode supply. 2. Vacuum-tight tank. 3. Aligning guides. 4. Viewing port. 5. Rubber glove for bar joining. 6. Welding power leads. 7. Drive box. 8. Mechanically driven rolls. 9. Crank for electrode drive. 10. Main power to electrode. 11. Power application rolls. 12. Electrical insulation ring. 13. Water jacket. 14. Zirconium ingot in melting cup. 15. Water inlet. 16. Water outlet. 17. Main power to melting cup. 18. Eyepiece. 19. Cart for removing melting cup assembly

With the exception of the aqueous or liquid metal homogeneous type of reactor, the fuels of all other existing reactors have been solid and have been encased in materials (cans or sheaths) which act as a barrier to coolant attack of the fuel and prevent fission products entering the coolant stream. The favoured coolants to date have been gases, e.g., air or carbon dioxide; water; or liquid metals, notably sodium or the autectic sodium-potassium alloy.

Beryllium

The sheathing or canning materials which have been used so far in gas cooled reactors for operating up to 400 deg C have been based on aluminium and magnesium. These particular metals have limitations, however, with regard to the temperature at which they can operate satisfactorily. It would be expected that beryllium with its better nuclear properties, its higher melting point (1,283 deg C), its good resistance to oxidising and reducing gases and to sodium, and its higher strength at temperatures about 500 deg C would be a suitable alternative.

Beryllium occurs in nature in the mineral beryl (an alumino-silicate) which is hand picked from the ore veins in which it occurs. The treatment of this ore to provide beryllium requires a complicated series of chemical processes and the complications of processing are aggravated by the health precautions which have to be taken in handling beryllium compounds.

Beryllium compounds are toxic. This toxicity, to which some people are prone, can manifest itself in the form of dermatitis, pneumonitis or carcinoma. Although non-radioactive in character (cf. plutonium) it demands facilities for handling which will prevent inhalation or ingestion of any beryllium by the operator. Regulations impose an atmospheric tolerance of less than 2×10^{-6} gm/cu m.

Beryllium metal has been made commercially by reduction of the fluoride with magnesium and by electrolysis of a fused salt chloride. The former method yields metal pebbles and the latter flake. Pebble metal is generally melted in vacuum to remove the excess magnesium of the reduction stage and to consolidate the individual pebbles. Although the metal can be cast, castings are generally of large grain size and contain both cracks and voids which are difficult to eliminate. Products from both reduction processes can be milled to a powder which after chemical treatment can be fabricated by powder metallurgy techniques to the required shape. Beryllium can be extruded either bare or, more generally, enclosed in a sheath of mild steel. This facilitates extrusion as well as providing a health safeguard. Temperatures of 1,050 deg C (for hot extrusion) and 450 deg C (warm extrusion) can be used. Extrusion pressures are higher and reductions much less at the lower temperature. The metal can also be sheath rolled in rod or sheet form. The metal is brittle at room temperature but becomes quite ductile above 200 deg C. Thus it cannot be readily cold worked and finishing operations are done warm. Beryllium can be machined although attention has to be paid to the structural condition of the metal (a fine grain is essential if a fine surface finish is required) and to the details of tool design, tool speeds and depth of cut. Beryllium can be pressure welded at 900 deg C and above; fusion welding is not attractive since the welds generally suffer from cracking.

One of the intermediates from beryl is beryllia (BeO). This ceramic with its high melting point and chemical inertness in dry oxidising or reducing atmospheres at temperatures up to 500 deg C for example, could be used as an alternative moderator to graphite. Its fabrication into

shapes by cold pressing and sintering and by hot pressing has entailed a considerable amount of research to define the conditions for achieving controlled porosity or high density. The oxide is characterised by volatility in atmospheres which contain moisture; thus sintering requires careful control for health reasons as well as for economy. In hot pressing graphite dies stand up to the pressures involved and do not contaminate the beryllia permanently, since heating in air after fabrication oxidises the carbon which diffuses during fabrication. Manufacture of components in beryllia by slip casting and by extrusion is also possible.

Zirconium

For water cooled reactors operating at temperatures of 300 deg C, zirconium and particularly the alloy " zircaloy " which contains about 1·5 per cent tin and some minor but essential additions of iron, nickel and chromium, provides the best material both from the nuclear aspect and metallurgically. This metal is found mainly in the minerals zircon (zirconium silicate) and the oxide, which also contain hafnium in amounts up to 3 per cent. Hafnium has a high affinity for absorbing neutrons and has to be removed from the zirconium before it can be used. This separation which is difficult by conventional chemical techniques can be achieved fairly readily by ion exchange or by solvent extraction. On the commercial scale, zirconium (after being freed of hafnium) is produced by magnesium reduction of the chloride (the Kroll process).

Zirconium metal is very reactive to oxygen and nitrogen. Unlike any of the metals mentioned so far the initial stages of reaction with oxygen (or nitrogen) results in considerable solid solution of the gases in the metal (up to 40 per cent in the case of oxygen) rendering it brittle at temperatures up to 300 deg or 400 deg C. This complicates fabrication and is the main characteristic of zirconium which determines the procedures to be adopted for its manufacture and fabrication; for example, arc melting in highly purified inert gas atmospheres, high vacuum furnaces for heat treatment or alternatively cladding in sealed mild steel containers which prevent access of oxygen to the zirconium have been developed to safeguard against pick up of gases. Nitrogen has to be avoided not only because of the fabrication difficulties, but because amounts in excess of 60 ppm. reduce the corrosion resistance of zirconium in high temperature water quite markedly. Zirconium too reacts with most metal containers and although it can be melted in graphite the carbon pick-up (like nitrogen) reduces its corrosion resistance. For this reason and because of its high melting point the manufacture of large cast billets of zirconium by arc melting is particularly appropriate.

If oxygen and other contaminants are avoided, zirconium can be extruded, rolled, cold worked and drawn. In drawing operations proper lubrication of the die is important since the metal is particularly susceptible to galling. The worked surface has to be removed by pickling afterwards to recover a corrosion resistant surface. Alloying of zirconium, although it gives improved physical and chemical properties, does not reduce the susceptibility to or the need to avoid oxidation and nitrogen or carbon contamination.

Zirconium can be welded by argon arc melting, again in a highly purified atmosphere. Brazing has not been fully developed. Machining can be done relatively easily, but attention has to be paid to the work hardening of this metal, its tendency to gall and build up on the tool, its pyrophoricity and the abrasiveness of the oxide. The pure metal has low creep strength above 400 deg C, but alloying with molybdenum, tin or aluminium in amounts up to 5 per cent confers greater creep resistance even up to 550 deg C.

The cooling of advanced types of reactors by liquid metals is a feature of nuclear energy reactors which is only now making itself felt. Sodium is not a particularly corrosive metal unless its oxygen content is high. High in this context means greater than 20 ppm. For the highly rated future reactors which will operate at temperatures in the region of 600 deg C metals with good creep strength and high corrosion resistance are required, associated of course with good nuclear properties.

Niobium

One likely material is niobium, which has a high melting point (approx. 2,500 deg C), good ductility when pure, but poor oxidation resistance. It occurs in association with tantalum. This has poor nuclear properties, but can be separated from niobium by solvent extraction or ion exchange. Metal extraction processes provide niobium in the form of powder. This can be consolidated by a combination of powder metallurgy techniques generally cold pressing and sintering at up to 2,200 deg C and high vacuum. The sintering operation also tends to eliminate such oxygen as may have been picked up. Its final shaping by cold processing with interstage annealing so designed as to avoid the pick-up of oxygen and nitrogen demands highly controlled methods and skilled operation.

The author has not considered all the special materials of atomic energy and has not discoursed upon the manufacture of such other materials as heavy water, graphite and hafnium; of ceramics like uranium oxide and carbide; of cermets (mixtures of metals and ceramics) like boron carbide in aluminium for control rods; of coolants like bismuth; and of the special materials for those parts of atomic energy plants outside the core of the reactor. Yet although atomic energy development will demand its special materials there is still a continuing urge to develop some of the commoner materials of industry, for which technologies are well known. Two examples of these may be quoted. Recent experiments have shown that in static waters, aluminium alloys based on nickel as a main alloying addition but with small amounts of other elements which improve the stability of the oxide film do not corrode in water (pH 6-7) at 300 deg C over long periods; if these properties can be maintained in dynamic systems, the use of aluminium alloys in lieu of zirconium in water cooled reactors may become a real possibility. The second example is the development of a magnesium alloy for the Calder Hall gas cooled reactor. The magnox series of alloys remain quite unreactive to carbon dioxide at the proposed temperatures of operation and also have the merit of not being as inflammable as pure magnesium when molten. Perhaps the greatest field for development of modified conventional materials will be found in those engineering parts outside the core itself.

Handling of Radioactive Materials

If developments which have been described and the difficulties which have been surmounted appear considerable, the conclusion to this article may perhaps refer to a future problem for which no detailed solution exists at present. This is the problem of re-fabricating irradiated materials, particularly irradiated fuel elements which have not been chemically treated to remove all radioactivity, but only partially " depoisoned " of fission products. Such fabrication will require to be done behind several feet of concrete by remote methods and may involve alpha active materials, e.g., plutonium which will need sealed chambers. This is a field of development in which automatic control will have to play a very considerable part and in which all types of techniques, electrical, mechanical, pneumatic, hydraulic, will exercise the ingenuity of the engineer to achieve cheapness in processing with what can only be costly capital equipment.

Developments in Electrical Materials

Dr. Willis Jackson's Address to the Institute of Metals

THE possibilities opened up in electrical engineering by the improvement of well-established materials and the economic development of what might properly be called, from the engineering point of view, new ones, were discussed by Dr. Willis Jackson, F.R.S., Director of Research and Education, Metropolitan-Vickers Electrical Co., Ltd., in the 46th May Lecture delivered to the Institute of Metals at the Royal Institution last week, at which the president of the Institute, Dr. Maurice Cook, took the chair.

Dr. Willis Jackson emphasised that striking examples of the intimate inter-relationship and the growing interdependence of progress in physics, chemistry, mathematics, metallurgy and engineering had occurred in electrical engineering. The past few years had seen the emergence to considerable engineering significance of a number of metals which had previously found only limited, and, in some cases, no engineering application.

Dr. Jackson foresaw that the thermionic valve type repeaters installed in the new transatlantic submarine telephone cable would, before long, be replaced by ones with germanium or silicon transistors, which also had application in guided missiles and computers. The original point-contact type of germanium transistor was now being superseded by the so-called junction type, capable of handling larger currents, and for diodes at least germanium was likely to be replaced by silicon, because the latter could withstand higher reverse voltages and operate at higher temperatures. These devices required the production of large single crystals from which tiny pellets could be cut, of which the impurity atoms present were of the order of only a few parts in 10^8—an achievement calling for considerable metallurgical skill and ingenuity.

Liquid sodium, or a sodium potassium alloy, to be used as the cooling medium in the fast power reactor at Dounreay, might well be used in the next line of thermal power reactors to be developed in this country, either running in parallel with the final phase of the gas-cooled reactor plan of the 1955 White Paper or superseding it from the mid-1960s. The extremely low neutron absorption of liquid bismuth, combined with its ability to carry a small, but adequate, proportion of uranium in solution, introduced the possibility of developing liquid fuel reactor systems.

Dr. Willis Jackson also mentioned the cold rolled, highly orientated sheet steel, new permanent magnet materials, and the ferrites, a post-war development which was beginning to exercise a considerable influence on the design of telecommunications equipment.

Barium Titanate Ceramics

The remainder of his paper was devoted to the ferroelectrics—" the dielectric analogue of ferromagnetics." He discussed the features and qualities of the ceramic form of titanium dioxide, with its high permittivity. He explained how the unit cells of this were cubic at temperatures above 120 deg C, but on passing downwards through this temperature (termed the " curie point " by analogy with the loss of ferromagnetic properties which occurred in iron at a temperature known as the curie point) it became tetragonal, in which state one cube edge—the *c* axis—became 1 per cent longer than the other two, the *a* axes. Because this class of material exhibited electrical properties closely analogous to the magnetic ones of ferromagnetic materials, the term ferroelectric had been applied.

The residual internal mechanical stresses present in ceramic titanium oxide specimens restrained the response of the individual crystallites to applied electric stress, and experimental evidence indicated that the application of a stress of 30 kV/cm was not normally capable of orienting the *c* axis of more than 10 per cent of the unit cells into the field direction, with corresponding reduction in the dimensional response.

Wide Application

Apart from the use of barium titanate ceramics in producing high value capacitors of small dimensions, the preparation of very thin plates with high electric strength would provide a very desirable replacement for the electrolytic capacitor, and capacitance value of the order of a microfarad per cu cm had actually been achieved on an experimental basis.

A further field of application was the use of the extremely high rate of permittivity in the vicinity of the curie point—a much higher rate of change than was attainable in thermally sensitive resistors. The 120 deg C curie point of barium titanate could be reduced to one of room temperature by the replacement of 28 per cent of the barium titanate by strontium titanate, and indeed a wide range of temperature coefficient could be obtained at room temperature by variation of the barium-strontium proportions.

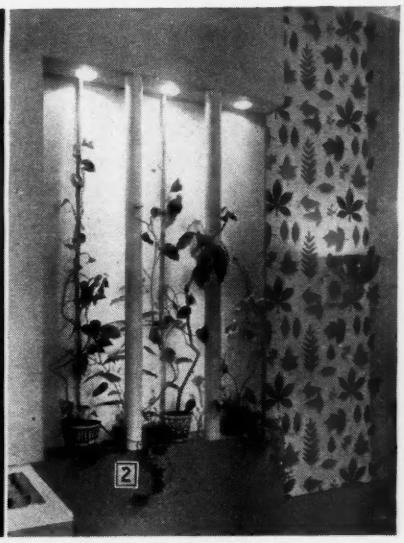
Dr. Jackson described a typical two-dimensional binary storage arrangement for a digital computer on a crystal of barium titanate. It comprised a set of parallel line electrodes on one face of the crystal lying perpendicular to a second set on the attenuated face. These electrodes could be deposited on the surfaces by evaporating metal through slits in a mask. The individual storage cells were found at each cross-over point. In an experimental assembly on a crystal 0·3in square and 0·002in thick, 256 cross-over points had been provided and operated without mutual interference. Ferroelectric storage devices were not yet so far advanced as ferromagnetic ones, but the latter had relative disadvantages.

By appropriate orientation of the relative directions of the polarising and alternating stresses, several modes of mechanical vibration might be excited—an electrostriction analogous to magnetostrictive characteristics of ferromagnetic materials. An important application of this electrostrictive property was to high power ultrasonic generators. Barium titanate was being extensively used in the United States as a replacement for Rochelle salt in gramophone pick-ups. Against the smaller electromechanical response were the advantages of a much reduced temperature variation of its characteristics and a more extended operating range of temperature, and, in contrast to Rochelle salt, this material was not affected by humidity.

The future prospects of wide application of this new class of ceramic material were bound up with the production of materials of more stable characteristics and higher electric strength than had yet been attained. The work carried out so far should be regarded as no more than the opening phase in a new field of ceramic technology.

Lighting Service Bureau

EXAMPLES OF MODERN DECORATIVE SCHEMES



DURING a recent visit to the architectural lighting studio at the Lighting Service Bureau of the Electric Lamp Manufacturers' Association we saw some excellent schemes representing advanced ideas of or contributing to decorative lighting. The accompanying pictures tell their own story in conjunction with the following notes.

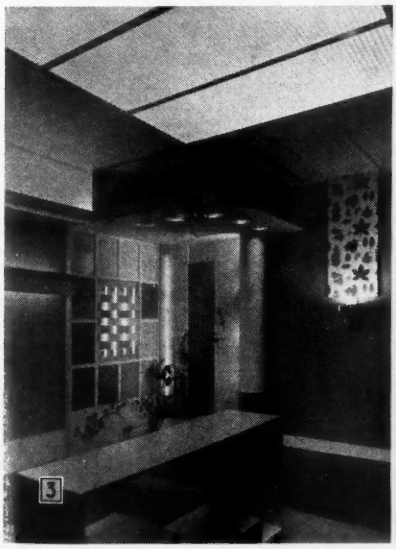
1. The column on the right conceals adjustable reflector lamps the light from which can be directed on to the facing wall to demonstrate the effect of reflection from various surfaces, including brick, matt and glossy paints, wood and wallpaper. The ribbed glass column in the corner covers a single 8ft fluorescent lamp, while architectural tubular lamps, interwoven with metal strips, form the decorative panel on the left.

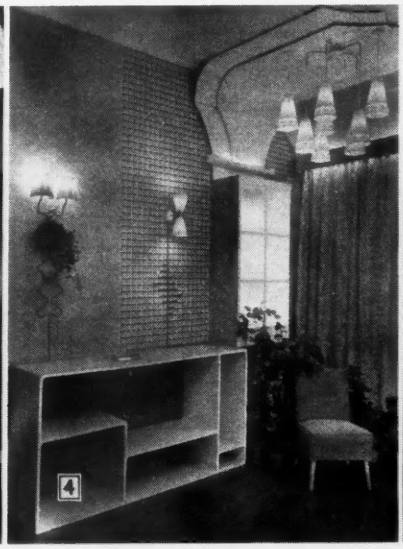
2. Indoor plants lit by 5ft 80 W colour-matching fluorescent lamps in semi-circular reflectors against a light blue background. An alternative system is provided by three 75 W reflector lamps installed above.

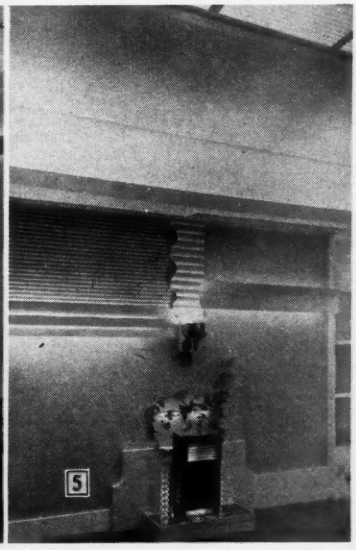
3. Corrugated plastic conceals de luxe warm white and colour-matching fluorescent lamps for the general lighting of the room. The suspended canopy in the corner houses polished aluminium reflectors, the upward spill of light forming a decorative pattern on the ceiling within the "cage." A white-painted corrugated asbestos panel on the ceiling conceals the wiring to the laylight.

4. On the ceiling, pendant shades are hung at different heights in a cluster to provide a major decorative feature from the most elementary form of fitting. Wiring is concealed behind the simple hardboard moulding. The case below demonstrates the effect of fluorescent and filament lamps when seen through various types of glass. Both the wall brackets provide examples of decorative surface wiring. Lead covered cable in a design which links up with that of the fitting on the left is painted bright blue; on the right mineral-insulated cable has been given a contemporary treatment to harmonise with the more severe wallpaper and fitting design. Both methods provide great scope for adaptation and can considerably reduce the cost of wall-bracket installation.

5. Two baffles or "open-topped pelmets" mounted at different heights are here used for background lighting by fluorescent lamps. Alternative wall surfaces are used above and below the fitments to indicate the varying effects. The front of the "pelmet" on the left is illuminated by a small spill of light from the interior. Fluorescent lamps are also used in the totally indirect cornice above.







Engineering in Europe

ABSTRACTS FROM FOREIGN TECHNICAL JOURNALS

IT is possible to derive theoretical expressions for the torque of relays without non-linear elements and to investigate by their aid the characteristics obtainable by such relays. It is found that all the types of characteristics actually needed for protection purposes should be obtainable by relays without non-linear elements. A further step is then the design of the relay windings required to produce these characteristics and the theoretical control and practical testing of such relay designs. Lastly, it is obvious that there must be fields of application for which one or the other type of relay will present greater advantages.

The advantages of relays using non-linear elements, particularly diodes, are: possibility of obtaining a torque depending strictly on one variable parameter when the others are kept constant at the boundary of the zone of action of the relay (not of circular or linear shape); simpler actuating elements; possibility of using amplifiers; possibility of using permanent or d.c. magnets, thus avoiding the need for instrument transformers for power supply; and simpler and higher-speed relay designs.

The disadvantages are: relatively high numbers of diodes required, which have to be protected against overcurrents and voltages; slower operation of the d.c. circuits compared with a.c. circuits; difficulties in stabilizing the variable torques; low efficiency of circuits producing desired torque characteristics; the fact that the torque is linearly, but not quadratically, proportional to the variable quantities; and the low resetting coefficient. Relays with saturable magnetic circuits have comparable advantages and drawbacks.

The conclusion drawn by the author is that relays without non-linear elements (multi-pole relays) deserve preference where optimum accuracy of operation is required or where the range of variation of the variables is particularly wide, or where both conditions are simultaneously imposed.—" Protective Relays Not Using Non-Linear Elements." V.L.Fabrikant, *Elektrichestvo,* No.12, pp.53-59, 1955, in Russian.

Using Transformer Heat Losses

It is shown that the utilization by heat pumps of the waste heat of transformers in all-the-year-round operation justifies an initial investment which may be higher as coal prices rise, if electricity tariffs are lower and if the efficiency of the heat pump installation is high. Half-yearly operation of heat-pumps restricted to the hours of daylight during the winter season is uneconomic. The economically justifiable limiting specific costs of the operation of heat pumps are represented in graphs as functions of the total duration of annual operation and may be compared with the primary costs of the plant. The economy of such a plant also depends on the form in which the heat so gained is utilised, e.g. in living rooms and workshops with large wall and ceiling areas for heat transfer. On the other hand, hot-water and other central heating systems may also, and in many cases more economically, be supplied with the waste heat from transformers by simple and cheap heat exchangers combined with thermostatically controlled transformer cooling systems. Such plants are economic even for half-yearly operation.—" Utilization of the Heat Loss of Transformers by Heat Pumps and Heat Exchangers and Its Economic Limitations." V.Aigner, *Elektrizitätswirtschaft,* Vol.54, No.23, pp.825-831, December, 1955, in German.

Generator Protection

The general scope of the use of distance protection systems for generator protection is surveyed in the introduction to the paper. It is easy to understand that the response of generator protection to faults in the neighbourhood of the generator, particularly on busbars, must be practically instantaneous and thus has to supplement and back up the other protective equipment of the sector. The basic propositions of the introduction are then illustrated by analysing various cases of transformer-generator and busbar connections to be met in power stations and the types and positions of faults to be expected, including calculation of the short-circuit currents; the operation of relays is then considered according to their point of installation and connection, etc. Switching operations, the correctness of measured impedances in the case of asymmetrical short-circuits and the adjustment of the relays are also discussed. The adjustment of generator protection is always delicate, since it has to conform to the switching operations on, and general operating conditions of, the outgoing lines.— " Use of Distance Protection Installations for Generators." B.Zaboj, *Elektrotechnicky Obzor,* Vol.45, No.1, pp.25-31, 1956, in Czech.

Temperature of Machine Windings

The method presented enables the winding resistances to be measured directly on load and temperature-rise and cooling curves to be obtained. Such curves are shown for windings of air and oil-cooled transformers heated by d.c. The mean temperature of the windings in a.c. conditions is most easily obtained for Y-connected three-phase windings in a short-circuit test. Asymmetry of the phase-voltages and the presence of higher harmonics between the neutral points of the windings is responsible for a residual alternating voltage even in short-circuit conditions. For this reason the winding resistance cannot be ascertained with the conventional circuits for d.c. resistance measurements. Bridge circuits or the voltmeter-ammeter method must be used.

The circuit described is specifically designed for the measurement of the d.c. resistance of the windings by voltmeter-ammeter in the presence of an alternating voltage; another variant uses compensating transformers and is also based on the voltmeter-ammeter method. An investigation carried out in the Central Electrical Research Laboratory on the accuracy of measurements of the resistance of transformer windings in the presence of alternating voltages by bridge methods yielded the result that the same accuracy could be obtained in measurements without and with alternating voltages up to 300 V (accuracy to 5 digits).— " Determination of the Mean Temperature of Windings from the Resistance." I.A. Syromyatnikov, *Elektrichestvo,* No.12, pp.43-47, 1955, in Russian.

Readers who require accurate full translations of any of the articles abstracted in this section can be put into touch with the translators who will supply them at current rates.—Editors, *Electrical Review.*

British Industries Fair

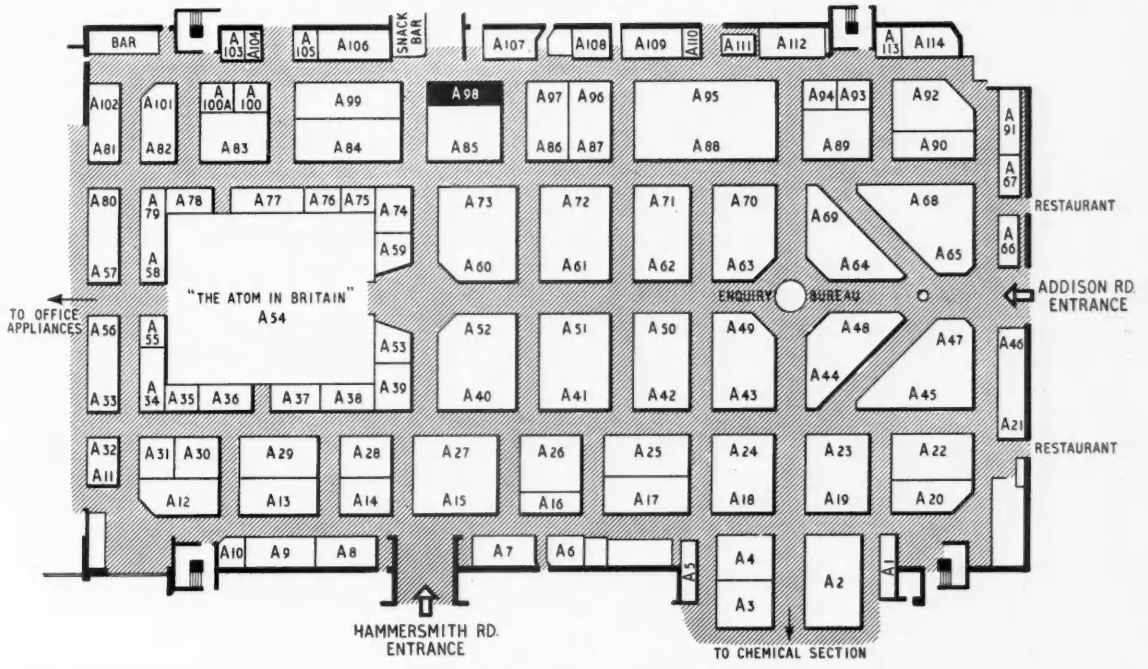
LONDON AND BIRMINGHAM ELECTRICAL EXHIBITS

COMMENCING next Monday and continuing until Friday, 4th May, the British Industries Fair is being held simultaneously at Olympia, London, and Castle Bromwich, Birmingham. The Olympia Fair will be opened by Mr. R. A. Butler, Lord Privy Seal, and it is anticipated that the Russian leaders, Mr. Khrushchev and Marshal Bulganin, will visit Castle Bromwich on 23rd April. Her Majesty the Queen, accompanied by the Duke of Edinburgh, will visit Olympia on 26th April.

For the first time the Electrical Section, which in previous years has been staged at Castle Bromwich, has been transferred to London, but in view of the recent statement by Mr. Thorneycroft, President of the Board of Trade, when he announced the Government decision to withdraw financial support after this year's event, it now seems that this will be the only London appearance. Other Olympia exhibits will include chemicals, household appliances, electronic plant and equipment, office appliances and scientific instruments, while at Castle Bromwich, engineering, building, heating, electrical, industrial and

ALPHABETICAL LIST OF ELECTRICAL EXHIBITORS AT OLYMPIA WITH PLAN OF ELECTRICAL SECTION

Exhibitor	Stand No.
Acru Electric Tool Mfg. Co., Ltd.	A 55
Aidas Electric, Ltd.	A 30
Allen West & Co., Ltd.	A 41/A 51
Anglo-Netherland Tech. Exchange, Ltd.	A 104
Bastian & Allen, Ltd.	A 36
Belling & Co., Ltd.	A 85
Belmos Co., Ltd.	A 15/A 27
Benn Brothers, Ltd.	A 16
Berry's Electric, Ltd.	A 44/A 48
Best Products, Ltd.	A 7
B.K.B. Electric Motors, Ltd.	A 17
Blackburn, C. H., & Co., Ltd.	A 76
Brattel Electric Co., Ltd.	A 77
British Electrical and Allied Manufacturers' Association	D 42
British Electrical Development Association	A 60/A 78 D 22/D 23
British Insulated Callender's Cables, Ltd.	A 81/A 102
British Thomson-Houston Co., Ltd.	A 64/A 69
British Vacuum Cleaner & Engineering Co., Ltd.	A 82/A 101
Brook Motors, Ltd.	A 63/A 70
Bruce Peebles & Co., Ltd.	A 40/A 52
Bulpitt & Sons, Ltd.	A 25
Butement, Colin, Ltd.	A 110
Cable Makers' Association	A 9
Campbell Engineering Co., Ltd.	A 111
Central Electricity Authority	A 88/A 95
Chilton Electric Products, Ltd.	A 100
Clang, Ltd., Crown Yard	A 103
Columbus-Dixon, Ltd.	A 58/A 79
Continental Shade Company	A 5
Corfield-Sigg, Ltd.	A 100
Crompton Parkinson, Ltd.	A 43/A 49
Dimplex, Ltd.	A 74
Electric Construction Co., Ltd.	A 89
Electric Light Fittings Association	A 39
ELECTRICAL REVIEW	A 98
Electrix, Ltd.	A 20
Ellison, Alfred, Ltd.	A 84
Ellison, George, Ltd.	A 84
E.M.I. Electronics, Ltd.	D 25
Enfield Cables, Ltd.	A 38
English Steel Corporation, Ltd.	D 19
Evershed & Vignoles, Ltd.	A 14
Ferranti, Ltd.	A 42/A 50
Fitzgibbon & Murray, Ltd.	A 105
Fuel Efficiency Co., Ltd.	A 35
General Electric Co., Ltd.	A 61/A 72
Hackbridge & Hewittic Electric Co., Ltd.	A 92
Hawkins, L. G., & Co., Ltd.	A 22
Hollman, Oswald, Ltd.	A 106
Hoover, Ltd.	A 18/A 24
Hotpoint Electric Appliance Co., Ltd.	A 83
Houchin, Ltd.	A 37
Imperial Chemical Industries, Ltd.	A 57/A 80
Kandel & Co. (Merchants), Ltd.	A 5
Langley London, Ltd.	A 31
Lec Refrigeration, Ltd.	A 6
Long & Crawford, Ltd.	A 75
McGeoch, William, & Co., Ltd.	A 28
Marston Excelsior, Ltd.	A 57/A 80
Mason & Lewden, Ltd.	A 113
Metropolitan-Vickers Electrical Co., Ltd.	A 65/A 68
Midland Electric Mfg. Co., Ltd.	A 19/A 23
Miller-Kent Decoratives	A 107
Modern Electrical Industries, Ltd.	A 78
Neon Displays (Tekniglas), Ltd.	A 10
New Welbeck, Ltd.	A 34
Newman Industries, Ltd.	A 12
Osborn Manufacturing Co., Ltd.	A 67
Parsons, C. A., & Co., Ltd.	A 86/A 97
Reyrolle, A., & Co., Ltd.	A 87/A 96
Rheostatic Co., Ltd.	A 99
Rotaflex (Gt. Britain), Ltd.	A 11/A 32
Russell Newbery, Ltd.	A 20
Siemens Ediswan Group	A 62/A 71
Smiths English Clocks, Ltd.	A 26
South Wales Switchgear, Ltd.	A 33/A 56
Sterling Engineering Co., Ltd.	A 20
Stewarts & Lloyds, Ltd.	A 90
Temperature, Ltd.	A 114
Thomas, Bertram (Eng.), Ltd.	A 29
Tufnol, Ltd.	A 84
Wilkins & Mitchell, Ltd.	A 13
Winston Electronics, Ltd.	D 24
Yorkshire Copper Works, Ltd.	A 45/A 47



factory equipment and hardware items are to be displayed.

Over eighty exhibitors are occupying stands in the Electrical Section (compared with rather fewer than fifty at Birmingham last year) and a highlight of the section will be the first showing in this country of the "Atoms for Britain" exhibit arranged by the United Kingdom Atomic Energy Authority. Many of Britain's leading electrical manufacturers will also be showing equipment foreshadowing developments in automation and the use of nuclear power in industry. Among associated reactor instruments on show, forming part of a reactor control room, is a health monitor to indicate the prevailing gamma radiation level in working areas around an atomic pile. The Atomic Energy Authority's exhibit, covering an area of about 8,000 sq ft, shows many peaceful applications of atomic energy in industry and will be the biggest display of its kind to be given in this country.

The *Electrical Review* will occupy a stand in the Electrical Section (A.98) and representatives from all departments will be available to give every possible assistance to visitors in any matter relating not only to the exhibition but to the electrical industry generally. The telephone number of the stand is Fulham 8404.

Available free from the *Electrical Review* stand is a comprehensive list of the exhibitors in the Electrical Section, together with a map. This has been printed in the form of a folder to serve as a guide which will be of assistance both to visitors and exhibitors. The official catalogue will be available at the Fair, price 2s 6d per copy.

Trade buyers are admitted to both sections of the Fair every week-day from 9.30 a.m. to 6 p.m., except on the last day when the closing hour will be 4 p.m. Overseas buyers are admitted free; home buyers can obtain badges, for 5s, which will admit them to both the London and Birmingham sections throughout the duration of the Fair. Day tickets cost 2s 6d for each section. The public is admitted each day after 2 p.m. and all day on Saturday, 28th April, for 2s 6d for each building.

GUIDE TO THE EXHIBITS—OLYMPIA

Acru Electric Tool Manufacturing Co., Ltd., Chapel Street, Levenshulme, Manchester, 19.—**Stand A.55.**—Thermostatically controlled soldering irons.

Aidas Electric, Ltd., Sadia Works, Rowdell Road, Northolt.—**Stand A.30.**—"Sadia" storage water heaters from 1½ to 30 gal capacity are shown and in the 40 to 60 gal range there is the 60 gal type KS water heater with 9 kW loading. In addition there is a selection of immersion heaters.

Allen West & Co., Ltd., Brighton, 7.—**Stand A.41/A.51.**—In addition to a wide selection of standard motor starters, both hand-operated and automatic designs, and oil-break switchgear, this company is showing two important developments in the field of crane control.

Anglo-Netherland Technical Exchange, Ltd., 3, Tower Hill, London, E.C.3.—**Stand A.104.**—A new 6 V pencil-size soldering instrument, the "Oryx" model 18, weighs only 1 oz and is claimed to have the heat capacity of a normal soldering iron. The instrument is fitted with a detachable $\frac{3}{16}$in bit of a special alloy to ensure high conductivity and durability. A new instrument developed for the textile industry is also to be seen.

Bakelite, Ltd., 12-18, Grosvenor Gardens, London, S.W.1.—**Stand C.73/C.94.**—Emphasis is placed on a range of plastics having good chemical resistance which include "Vybak" p.v.c. in sheeting and pipe form; "Shalon" monofilament, recently introduced by the company as a brush filling material; "Warerite" laminated plastics; "Bakelite" syntactic foams; "Microballoons"—tiny spheres of phenolic resin which contain nitrogen gas and are employed for evaporation control in the oil industry; chemically resistant surface coatings; and a glass fibre reinforced polyester cage for plating.

Bastian & Allen, Ltd., Ferndale Terrace, Harrow.—**Stand A.36.**—Steam boiler equipment exhibited includes a "Speedylectric" steam jet cleaner, rated at 20 kW at 400 V, 3-phase, 50 c/s; a 1,175 lb/hr electrode steam boiler; "Stanmore" (117 lb/hr) and "Autolec" (235 lb/hr) packaged electrode steam boilers; an electrode hot water boiler with an output of 100,000 B.Th.U./hr and another, with motorised load control, having an output of 2,000,000 B.Th.U./hr; and a range of "Satomair" humidifiers.

Belling & Co., Ltd., Bridge Works, Enfield, Middlesex.—**Stand A.85.**—A new range of cookers in eight colour combinations is shown. The main emphasis is on the 47AB cooker with inner glass door and removable oven lining; a fully automatic model of this cooker ("47 plus") will be displayed together with the "64 plus" automatic cooker. A new range of "Zephyr" convectors is also to be seen.

Belmos Co., Ltd., Bellshill, Lanarkshire.—**Stand A.15/A.27.**—Flush-fronted multi-tier switchboards, including the recently introduced four- and five-tier formation; type "E" pillar as used for electric furnace control; a control desk with mimic diagram for operating a switchboard in a coal preparation plant; and contactor units for capacitor switching in p.f. correction. Flameproof equipment includes a gate end box, drill control unit, lighting fittings, etc.

Berry's Electric, Ltd., Touchbutton House, Newman Street, London, W.1.—**Stand A.44/A.48.**—"Magicoal" and "Berrylog" fires are on show in great variety, from a period reproduction grate selling at over £100 to a tiny log fire for use where only the glow is wanted. There are Elizabethan, Jacobean, Queen Anne, Georgian, Adam and Regency fires, and a wide selection of modern patterns. Radiators include the built-in "Mistoberry" with double lighting and the full "Raydair" range. The "Raydair" background heaters are now available as free standing or wall mounting models, with or without variable thermostatic controls. In addition there are "Raydair" greenhouse heaters. Lighting fittings follow the periods of the fires through hewn oak, wrought iron and gilt chandeliers to contemporary designs. The water heating section includes immersion heaters from 11½ to 36in and the popular "New Look" storage heaters. In addition to the 1½ and 2½ gal heaters there appears for the first time a 3 gal model.

Best Products, Ltd., Felix Works, Felixstowe, Suffolk.—**Stand A.7.**—"Fanfare" and "Family" electric kettles, elements, coffee percolators and vacuo junctions for measuring small electric currents of audible and radio frequencies.

B.K.B. Electric Motors, Ltd., St. George's Works, 132 Icknield Street, Birmingham, 18.—**Stand A.17.**—Special a.c. and d.c. electric motors made to customer's specifications.

C. H. Blackburn & Co., Ltd., 10, Gray's Inn Road, London, W.C.1.—**Stand A.76.**—Various models from a range of electrically heated food conveyors; hot food cupboards, with and without bain-marie hobs; hot and cold water sterilisers; utensil and instrument sterilisers; and immersion heaters.

Brattel Electric Co., Ltd., 27, Old Bond Street, London, W.1—**Stand A.77.**—The "Hostess" infra-red home grill (750 W) and the "Super Chef" infra-red catering grill (2 kW), the latter operated by "Simmerstat" control, are shown, together with the new fully automatic "Tudor" infra-red rotary spit. This is fitted with two-hour automatic self-timer pre-set heat control, long life heating elements, etc. Cooking is visible and the bottom and top sections can be used at the same time. A unit which enables an ordinary iron to be converted into a steam iron is displayed.

British Electrical Development Association, 2, Savoy Hill, London, W.C.2.—**Stand C.11.**—"Atoms in the Kitchen" foreshadows the kitchen of the future, using electricity generated by atomic energy. The kitchen is equipped with examples of the latest types of cookers, water heaters, refrigerators, washing machines, ironers, dishwashers, spin dryers and a sink with a motor-driven refuse disposal unit. A separate section is devoted to automatic time-controlled electric cookers and a selection of time switches for the conversion of ordinary cookers to automatic working. Technical films, and E.D.A. films more suited to the general public, are screened at intervals each day.

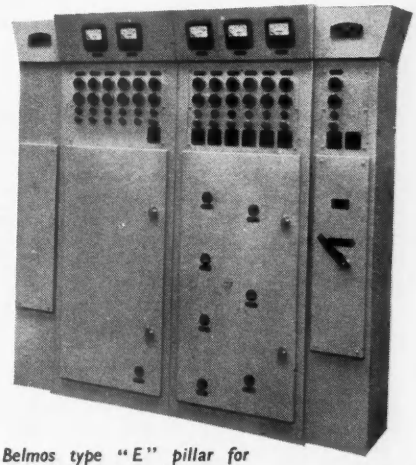
British Insulated Callender's Cables, Ltd., Norfolk House, Norfolk Street, London, W.C.2.—**Stand A.102/A.81.**—Cables and equipment for specialised industries are shown, including a number of cables and accessories for mines and quarries. A new feature is a display introducing C.M.A. mineral insulated cables, together with a simplified method of termination. Other products shown include winding wires, p.f. correction capacitors, earthing equipment, claw type cleating systems and glands for armoured p.v.c. cables.

British Thomson-Houston Co., Ltd., Rugby.—**Stand A.64/A.69.**—Among the main exhibits of the company are marine radar equipment, switchgear, germanium and silicon power rectifiers, electric motors including f.h.p. sizes, industrial electronic equipment, and "Mazda" lamps and lighting equipment. Items which incorporate recent developments in design or manufacture include the 2 h.p. "Emotrol" (electronic motor control) equipment which demonstrates the flexibility and accuracy of motor speed control; waveguide test gear for the measurement of standing wave ratio and loss characteristics of r.f. feeders and wave-guides; a new design of electronic relay which uses a lead sulphide photo-conductive cell as the sensitive element; 3·3 kV class AL.6 air-break equipment, tested for a short-circuit rating of 250 MVA; and germanium and silicon power rectifier assemblies for mounting in cubicles, together with the associated transformers, instruments, and switchgear, as well as two complete germanium rectifier cubicles.

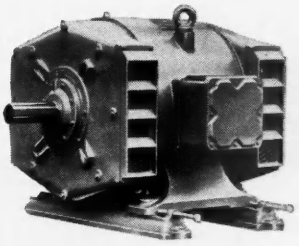
British Vacuum Cleaner & Engineering Co., Ltd., Goblin Works, Leatherhead, Surrey.—**Stand A.101/A.82.**—The company's exhibits include "Goblin" domestic appliances and the B.V.C. industrial vacuum cleaners from 500 W to 15 h.p. portable range, with some examples of fixed plants. Particular attention is drawn to the G.56 Goblin "Ace" cleaner, a new product, and the two latest electric washing machines, models W.130 and W.140, both of which are fitted for water heating and with automatic pumps, the W.140 having also an electric wringer. The company's subsidiary, the Magneta Time Co., makes master clocks, time recorders, slave and synchronous clocks and other articles of an associated nature, as well as a wide range of public address equipment, amplifiers, loudspeakers, microphones and other related apparatus.

Brook Motors, Ltd., Huddersfield.—**Stand A.63/A.70.**—The company's products shown include motors up to 600 h.p. In the "Gryphon" f.h.p. motor range a vertical mounting sleeve bearing type which will carry loading up to 28 lb is offered and the new "Merlin" f.h.p. motor, designed for the domestic appliance market, is also introduced. A starter for motors rated at up to ½ h.p. is available in the control gear section. This new automatic push-button starter (HAT) is of simple construction, using plastic mouldings, die castings and sheet metal pressings. A new hand operated star-delta starter (HSD) and two single-phase starters, one hand operated (HC1) the other automatic (ZC1) will appear for the first time.

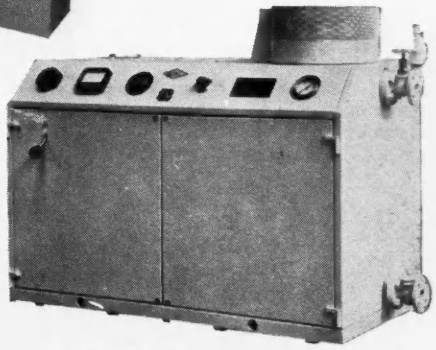
Bruce Peebles & Co., Ltd., Edinburgh, 5.—**Stand A.40/A.52.**—On view are a 1,000 kW geared turbo-generator for gas turbine drive, various sizes of transformers including part of a 120 MVA 275 kV auto-transformer with windings exposed for inspection, a partially erected 10 MVA transformer, a mobile battery charging rectifier for use in mines, and an extensive display of electric motors of many types up to 2,050 b.h.p. A scale model of a complete 24 MW power station illustrates the company's activities in the field of hydro-electric



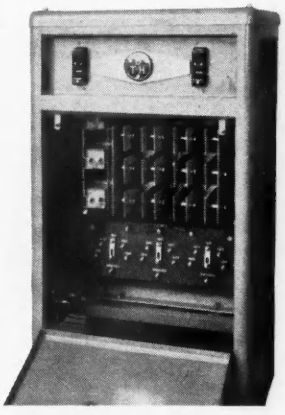
Belmos type "E" pillar for multi-motor group control



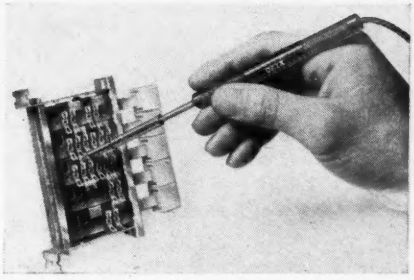
Brook drip-proof motor in the larger range up to 600 h.p.



Bastian and Allen "Autolec" packaged electrode steam boiler



B.T.H. germanium rectifier cubicle assembly



"Oryx" model 18 soldering instrument (Anglo-Netherland Technical Exchange, Ltd.)

work and there is also a model of a 144 MVA 15/295 kV generator transformer.

Bulpitt & Sons, Ltd., Swansea Works, Birmingham, 1.—**Stand A.25.**—Electrical appliances shown include kettles, coffee percolators, fires, toasters, urns, wash boilers, steam cookers, glue pots, heating pads, blankets, and immersion elements for domestic and industrial applications. A new model in the range of electric kettles is a 2 kW, 4-pint, high speed, whistling kettle finished in chromium plate on copper.

Colin Butement, Ltd., 20c, Pimlico Road, London, S.W.1.—**Stand A.110.**—Illuminated advertising signs.

BX Plastics, Ltd., Higham Station Avenue, South Chingford, London, E.4.—**Stand C.113.**—"Cobex" rigid vinyl, in sheets, blocks and tubes, is a corrosion resistant constructional material for plant such as ducting and trunking, fan casings, tank linings and facings, acid buckets, pickling baskets, component parts of laboratory and drawing office machinery and equipment for use where corrosive liquids or fumes are encountered.

Cable Makers' Association, High Holborn House, 52-54, High Holborn, London, W.C.1.—**Stand A.9.**—The C.M.A. exhibit presents pictorially various aspects of development, research and testing undertaken by members to ensure that whatever the problem set by industry, a C.M.A. cable of proven high standards can be produced to provide the answer.

Campbell Engineering Co., Ltd., Sherman Works, Bromley, Kent.—**Stand A.111.**—The company is showing immersion heaters with embedded and withdrawable type elements; the "Hotway" instantaneous sink water heater; the "Hotway" instantaneous shower heater; and a new 3½ pt 1,500 W electric kettle with automatic cut-out.

Central Electricity Authority, Winsley Street, London, W.1.—**Stand A.88/A.95.**—The Authority's display is devoted to the future generation of electricity from nuclear energy. Publications and general information regarding the organisation and progress of the electricity supply industry are available from an inquiry bureau.

Chilton Electric Products, Ltd., Hungerford, Berks.—**Stand A.100.**—Representative units from the range of "Atlas" miniature h.r.c. circuit-breakers for ratings up to 60 A and "Chilton" voltage-operated and core balance circuit-breakers are demonstrated on this stand. Also displayed are "Buk," "Kub" and "Twin" electric dry shavers, together with samples of shaver accessories and the "Chilton" home hair clipper.

Clang, Ltd., Crown Yard, Cricklewood, London, N.W.2.—**Stand A.103.**—A wide range of domestic and industrial electrical accessories includes weatherproof plugs and sockets. An addition to the company's conduit range is a ¾in male hook suitable for fluorescent fittings, etc.

Corfield-Sigg, Ltd., Trafalgar Works, Merton Abbey, London, S.W.19.—**Stand A.100A.**—Shown for the first time are two new domestic aluminium utensils in the "Crown Merton" range, an improved omelette pan and a long-handle colander, and a completely new range of heavy duty pans.

Crompton Parkinson, Ltd., Crompton House, Aldwych, London, W.C.2.—**Stand A.43/A.49.**—An animated scale model of an industrial trading estate demonstrates the part played by the company in carrying out complete industrial electrification projects at home and abroad. Particular emphasis is placed on the extent of equipment involved in providing for an electricity supply from an authority's main substation to all such industrial undertakings. For this purpose exhibits are as representative as possible, ranging from induction motors, generators, alternators, distribution transformers and switchgear to lamps and lighting fittings, instruments, f.h.p. motors and cable. Included in the main display is a working model of the company's Commonwealth type 955 h.p. diesel-electric locomotive. A standard "ALA1" 11 kV 250 MVA 400 A hand operated metalclad switchgear unit is fitted with "Perspex" windows so that the electrical and mechanical components of the unit's interior can be inspected. The main item of interest in the instrument exhibits is a hand driven tachogenerator coupled to a speed indicator. Other exhibits include a panel of twenty-five 3½in dial circular scale instruments and the movements of these instruments displayed in transparent cases. Two of the company's latest "F" design high efficiency a.c. ceiling fans with 48in sweeps are also being shown. F.h.p. motors, induction motors in the series 4 "KLOSD" range, and "New-Range" commercial and industrial fluorescent lighting fittings are displayed.

Dimplex, Ltd., Millbrook, Southampton, Hampshire.—**Stand A.74.**—Oil-filled electric radiators are available with loadings of from ½ to 2 kW, and finished in eight attractive colours, including light grey which replaces silver grey. A fully Buxton certified flameproof electric radiator and a gastight radiator are also shown together with prototypes of two new products, a permanently oil-filled electric towel rail and a permanently oil-filled airing cupboard heater.

Electric Construction Co., Ltd., Bushbury Engineering Works, Wolverhampton.—**Stand A.89.**—A working model illustrates the general principles of the method of gas cleaning by electrical precipitation; a demonstration and display of easily-assembled contactor switchgear as available in capacities up to 1,000 A; a complete stator of a 920 b.h.p. 11 kV 3-phase 0·9 leading p.f. synchronous motor for a compressor drive; a 175 b.h.p., 415 V, 1,500 r.p.m. slip-ring motor of screen protected type; a 190 b.h.p., 415 V, 1,500 r.p.m. air-blast self-cooled squirrel cage motor; a power transformer having aluminium windings; and an electronically controlled power unit for driving a pilot motor on induction regulator equipment for the purpose of providing automatic voltage or speed control.

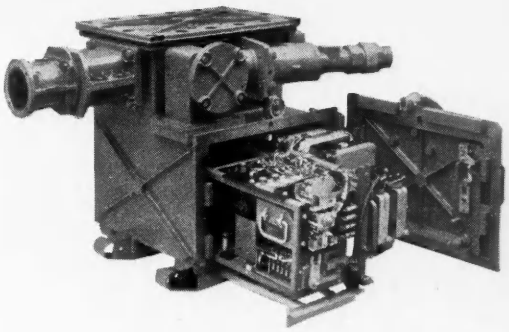
Electrical Review Publications, Ltd., Dorset House, Stamford Street, London, S.E.1.—**Stand A.98.**—Representatives are available at this stand to deal with inquiries relating to all matters connected with the electrical industry. The exhibit includes up-to-date and authoritative technical books on various aspects of electrical engineering; of special interest is the latest edition of the "Electrical Who's Who," a comprehensive personal directory containing some 7,000 biographies of people in all branches of the industry.

Electrix, Ltd., Sterling Works, Dagenham, Essex.—**Stand A.20.**—Products shown include the "Swiftclean," "Halcyon" and "Sterling" vacuum cleaners, a floor polisher and sprayer unit.

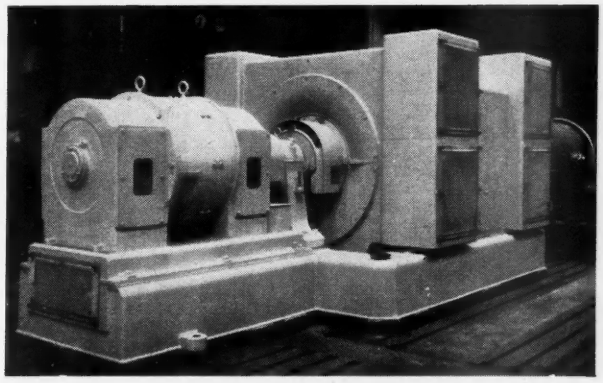
George Ellison, Ltd., Perry Barr, Birmingham, 22B.—**Stand A.84.**—This year the company is celebrating its jubilee and the varied range of products exhibited is a combined display showing the results of 50 years of progress. Included in the exhibit are electrical switchgear and hydraulic valves made by George Ellison, Ltd., soft grey castings made by Alfred Ellison, Ltd., and engineering components in "Tufnol." The switchgear ranges from an 11 kV circuit-breaker unit to motor starters of about 1 h.p.

Enfield Cables, Ltd., Victoria House, Southampton Row, London, W.C.1.—**Stand A.38.**—This stand, which is illuminated by means of the "Grid Suspension" wiring system, features the Enfield flat pressure cable; the company's contribution to the Commonwealth Trans-Antarctic Expedition; non-draining cables (mass-impregnated) for voltages up to 11 kV; and flexible moulded rubber connectors. Exhibits also include a wide range of rubber, thermoplastic and mains cables; compression cables up to 275 kV; bare hard drawn copper wire and strand; paper or cotton lapped wires and strips for transformer and machine winding; and h.v. and l.v. joint boxes.

Evershed & Vignoles, Ltd., Acton Lane Works, Chiswick, London, W.4.—**Stand A.14.**—Two new instruments among the wide range exhibited are a mains operated series 1 "Megger" insulation tester developed for three-voltage operation with testing voltages of 100, 250 and 500 V and a range extending up to 10,000 megohms, and an addition to the range



G.E.C. automatic flame-proof gate-end panel

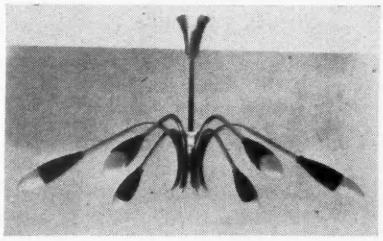


1,000 kW, 11 kV, 1,500 r.p.m. geared turbo-generator for gas turbine drive (Bruce Peebles & Co., Ltd.)

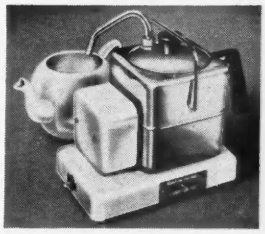
of series 2 instruments, a three-voltage hand driven "Megger" insulation tester having testing voltages of 250, 500 and 1,000 V and measuring up to 200 megohms. Another innovation is the replacement of aluminium by steel for the casing of the "Megger" series 2 intrinsically safe insulation and continuity tester to conform with a National Coal Board directive on the possible non-suitability of aluminium for use at the coal face. Other exhibits are testing sets; recording, measuring and indicating instruments; polarographs; an optical pyrometer; a thickness gauge; cable cleats; and the "Noflote" control equipment marketed by the Instrumentation and Controls Division.

Ferranti, Ltd., Hollinwood, Lancs. —**Stand A.42/A.50.**—A rural distribution transformer exhibited incorporates a core which consists of strips of low loss grain oriented steel wound into a coil, the overlapping joints being locked in position. As the flux path follows the grain of the steel and air gaps in the core structure are almost eliminated, the design gives lower iron losses and reduced magnetising current. There is also a special display of transformers with Class "H" insulation, showing the internal construction of the core and windings. The Instrument Department is represented by several demonstration units and a selection from a wide range of indicating and industrial instruments, including hermetically sealed types; a 7-range clip-on wattmeter, type "W"; clip-on ammeters; a disturbance recorder; maximum demand alarms; and power factor relays. The "Pegasus" and "Mercury" computers, the latter intended mainly for scientific work, are also shown. The meter display includes a new single-phase meter test set and a conversion panel for a high speed testing set for a.c. meters. Among domestic appliances are the "Fridge-Heater" Mk II, radiant electric fires and a display of electric clocks, including a new design of alarm clock which incorporates a 24-hour setting and a fully automatic relay setting of the alarm.

Fitzgibbon & Murray, Ltd., The Lower Mill, Kingston Road, Ewell, Surrey.—**Stand A.105.**—"Jeani" and "Ewell" bell lighting accessories and examples of machining of insulating materials.



6-light pendant ceiling fitting (Oswald Hollmann, Ltd.)



L. G. Hawkins "Tiffymatic" tea-making set

Fuel Efficiency Co., Ltd., 20, Upper Ground, London, S.E.1.—**Stand A.35.** —Cubicle type boiler instrument panel covering the whole range of operation in a modern oil fired multiple steam boiler plant; pedestal type desk panel; and Tempair "Viscount" and "Ambassador" self-contained air conditioning units for window or wall mounting, complete with cooling ($\frac{3}{4}$ ton or 1 ton refrigeration) and 2 kW heating.

General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.— **Stand A.61/A.72.**—A complete low-pressure rotor assembly for a 60,000 kW steam turbine weighing nearly 15 tons is one of the largest single exhibits to be seen at the Fair. A small rotor is also shown, illustrating the diversity in size of the company's products in this field. Completing the power equipment section is a 200 h.p. electric train motor similar to those supplied to the British Transport Commission for the Southend electrification scheme, and a new automatic flameproof gate-end panel used for controlling motors at the mine coal face. Installations of equipment for power generation, electric traction and mining are illustrated by background photographs. A second section of the stand is devoted to domestic equipment and household appliances. There is a new range of space saving cookers, and refrigerators now include a new internally lighted 4 cu ft table top model fitted with storage racks on the inside of the door and a reversible top shelf. Of interest to overseas visitors is the "Kwali" cooker, on show for the first time in this country. Another exhibit which will be seen for the first time is a room air conditioner, designed principally for the export market. Among the range of "Cosyglo" fires is the new "television" fire which reflects heat to the sides as well as the front and also has illuminated side panels giving a diffused light.

Hackbridge & Hewittic Electric Co., Ltd., Walton-on-Thames, Surrey.— **Stand A.92.**—Exhibits include one of two units forming a 1,500 kW combined mercury arc rectifier and air blast cooled transformer equipment for heavy duty d.c. traction supply (in operation); an invertor, electronic equipment and mercury vapour lamps; a 1,000 kVA class "H" transformer; a 33 kV on-load tap changer, with associated control cubicle; and a model of a 120 MVA 275 kV three-phase auto-transformer.

L. G. Hawkins & Co., Ltd., 30-35, Drury Lane, Kingsway, London, W.C.2. — **Stand A.22.** — The new "Tiffymatic" tea-making set has exclusive "cuppa-control" which permits from two to five cups of tea to be made automatically as required. Other introductions are the "Corgi" 2 pt 750 W polished aluminium kettle and a new range of convector fires.

Oswald Hollman, Ltd., 208, Kent House Road, Beckenham, Kent.— **Stand A.106.**—Electric light fittings,

table standards and lamp shades, including many contemporary styles.

Hoover, Ltd., Perivale, Greenford, Middlesex.—**Stand A.18/A.24.**—A new model of the Hoover Mk III washing machine incorporating an electric water heater is on show. Double-stretch "Hooverflex" hose for use with the cleaning tools of two of the Hoover cleaners is of flexible plastic reinforced with plastic coated spring wire and, elastic-like, it stretches to reach the farthest corner. The recently introduced model 638 cleaner, in blue and grey, is equipped with this hose as well as the new Hoover "Dustette." Among other appliances shown are an electric polisher and scrubber and the "steam-or-dry" iron. The display is completed by exhibits of f.h.p. motors and commutators, including examples of shaded pole motors and stator-rotor units. The induction type motors extend from $\frac{1}{6}$ h.p. to $\frac{1}{2}$ h.p. single-phase and up to $\frac{3}{4}$ h.p. three-phase.

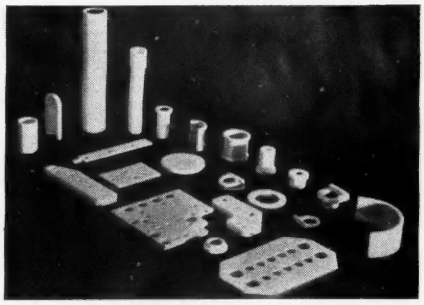
Hotpoint Electric Appliance Co., Ltd., Crown House, Aldwych, W.C.2. —**Stand A.83.**—This company's products include all the main home laundry lines, washers, ironers and airers, together with kitchen equipment and a new vacuum cleaner. "Coldrator" products include domestic refrigerators from 3 to 7 cu ft capacity, and also a series of refrigerator units. Premier Electric Heaters show an entire range of kettles, irons, fires, etc., on this stand.

Houchin, Ltd., Garford Street, London, E.14.—**Stand A.37.**—Items include a completely new development of small alternator frame sizes, a 10 kW alternator in the "SC" frame, and a 30 kW alternator in the new "B" frame, both types fitted with an exciter and having external regulation. There are also a standard "H.LD" frame alternator of 80 kW capacity and a "Mark A.10" 10 kW, 50/60 c/s frequency convertor.

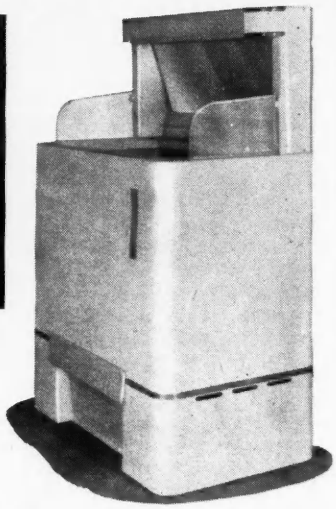
Imperial Chemical Industries, Ltd., Imperial Chemical House, Millbank, S.W.1.—**Stand A.57/A.80.**—The use of metal products for atomic energy purposes is illustrated and the display deals with the various forms of non-ferrous metal products manufactured by the I.C.I. Metals Division and an associated company, Marston Excelsior, Ltd., for heat exchange and associated work.

Langley London, Ltd., Kelvin Way, Crawley, Sussex.—**Stand A.31.**—Processed mica in all shapes and forms; mica splittings; commutator micanite; heat resisting micanite; laminated plastic tubes; moulding and flexible micanite; micanite tubes and vee rings; and silicone bonded glass fabric, laminates, laminated glass tubing and laminated glass mouldings.

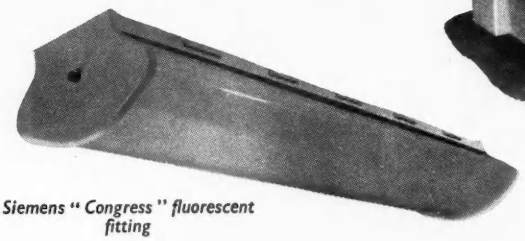
Lec Refrigeration, Ltd., Shripney Works, Bognor Regis, Sussex.—**Stand A.6.**—Refrigeration equipment includes 4·2 and 6 cu ft domestic models; a home freezer with a capacity for 25 gal ice cream or 200 lb frozen food; frozen food display cabinets fitted with mirror backed illuminated canopies; a 3 cu ft conservator; and 13 cu ft service cabinet. A $\frac{3}{4}$ h.p. air conditioner, hermetically sealed compressors, condensing units, complete refrigeration systems and all-aluminium evaporators are also shown.



Typical piece parts in silicone bonded glass laminates (Langley London, Ltd.)

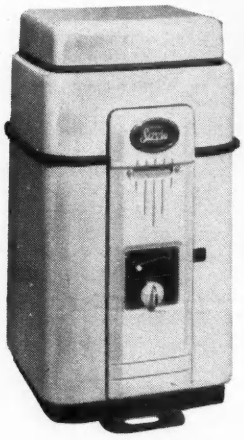


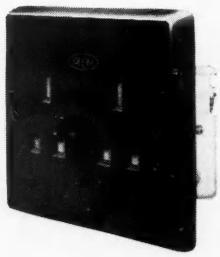
Lec Refrigeration FF.5 frozen food display cabinet



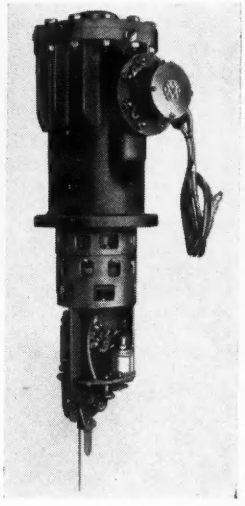
Siemens "Congress" fluorescent fitting

Below: Wilkins & Mitchell "Servis" model "S" with 4-minute timer





M.E.M. 2-gang flush socket-outlet



Right: Actuating mechanism for combined control and shut-off rods of a thermal reactor (Metropolitan-Vickers)

Long & Crawford, Ltd., Gorton Road, West Gorton, Manchester, 12. —**Stand A.75.**—Recent additions to the outdoor range of switchgear include the type "J" 400 A oil switch for 11 kV service which conforms with B.S. 2631 : 1956, but has the additional features of fully interlocked testing facilities on the cable terminals. An independent spring closing mechanism is fitted. A cable earthing and testing switch for use on the standard outdoor fuse switches and fuse circuit-breakers; type "TF" and "T15" fused circuit-breakers rated at 100 and 150 MVA, 11 kV respectively; and type "ETV2" oil fuse switch rated at 250 MVA at 11 kV are represented.

William McGeoch & Co., Ltd., Warwick Works, 46, Coventry Road, Birmingham, 10.—**Stand A.28.**—A number of standard fittings have been improved and redesigned, and in this category are indicator light fittings and control panels, and multi-pin pattern watertight sockets and plugs. Open type knife switches to 10,000 A, back-of-board switches, fusegear to 400 A, and high current slow break

units are among the switchgear exhibits and lighting fittings include watertight and weatherproof types and a selection of decorative lighting fittings, including period and contemporary patterns.

Mason & Lewden, Ltd., 5, Argall Avenue, Lea Bridge Factory Estate, Leyton, London, E.10.—**Stand A.113.**—The "Ceiling Master" ceiling fitting allows complete lighting fittings to be changed from room to room easily and speedily.

Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester, 17.—**Stand A.65/A.68.**—Principal exhibits include an actuating mechanism for combined control and shut-off rods of a thermal reactor—the company is supplying 120 of these mechanisms for the Calder "A" power station; a 25 h.p. type WPS weatherproof and splashproof ventilated squirrel cage motor for general industrial duty; a dual motor drive for a ring spinning frame; an MCU gate-end box as developed for the mining industry; and a type MDX motor for the iron and steel trades. Scale model exhibits include Castle Donington power station; a 100 MW hydrogen-cooled turbo-generator; a waterwheel generator; and a 9,000 h.p. geared Ward-Leonard Ilgner winder based on equipment for the National Coal Board.

Midland Electric Manufacturing Co., Ltd., Tyseley, Birmingham, 11.—**Stand A.19/A.23.**—Exhibits include a comprehensive range of switch, fuse and motor control gear; endurance testing apparatus and machines demonstrating the "Autoline" motor starters; and examples of the range of M.E.M. fires and convectors. New products introduced are a 2-gang flush socket outlet and a 30 A, 250 V cooker control unit to B.S. 1833.

Miller-Kent Decoratives, 56, Half Moon Lane, London, S.E.24.—**Stand A.107.**—Internally lighted large "flowers" in heavily moulded plastics are displayed. Of natural appearance, they are suitable for many purposes ranging from nursery room lighting to seaside illuminations. They are fireproof and easily washed and considerable numbers are made of plastics which are in fluorescent live colours which can be activated by ultra-violet light.

New Welbeck, Ltd., 120, New Bedford Road, Luton.—**Stand A.34.**—The company's industrial vacuum cleaners are all constructed on the principle of "free air flow"—no dust bag restricts the power of suction. The "Bak-Vak," a model designed to be carried on the back, enables dust to be removed from high and otherwise inaccessible places. With the combination "Duplex Bak-Vak" the power units are detachable and interchangeable; one can be transferred from the "Duplex" to operate the "Bak-Vak," permitting the "Duplex" to function simultaneously with the remaining power unit.

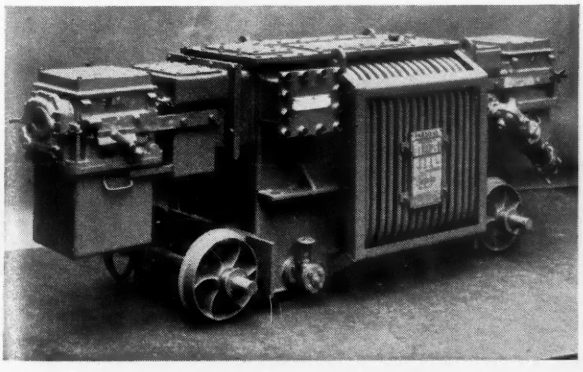
Newman Industries, Ltd., Yate, Bristol.—**Stand A.12.**—A representative selection of motors ranging from ⅛ h.p. "Elf" f.h.p. motors to 120 h.p. slip-ring motors includes those designed for B.S. dimension and specific duties such as flameproof, industrial, gasworks and pump motors. Particular emphasis is given to the company's flameproof motors and in order to demonstrate their efficient sealing one of these motors is shown continually pumping a cascade of water over itself.

Osborn Manufacturing Co., Ltd., 5-13, Highgate Square, Birmingham, 12.—**Stand A.67.**—Electric lighting fittings, fires, incinerators and paint scrapers are shown. The last-named are claimed to be the only industrial paint scrapers which burn off and scrape in one action. A prototype of a new scraper is also being exhibited.

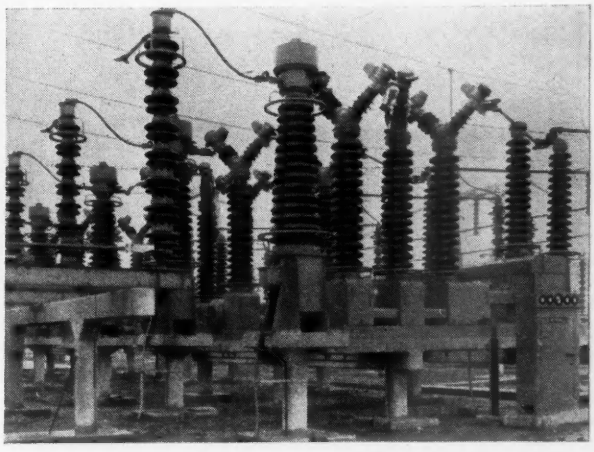
C. A. Parsons & Co., Ltd., Heaton Works, Newcastle-upon-Tyne, 6.—**Stand A.86/A.97.**—The main exhibits are a model of a 200 MW turbo-generator with a sectional arrangement drawing to show the internal construction; a completely bladed high pressure turbine shaft for a 60 MW 3,000 r.p.m. three cylinder turbine; a showcase containing examples of turbine blading for high pressure steam conditions and for the exhaust end of low pressure turbines; a model of 120 MVA 3-phase 50 c/s star connected auto-transformers, for use at the points of interconnection between the 275 kV and 132 kV systems of the C.E.A.; and a mining type transformer 150 kVA 3-phase 50 c/s 3,150/600 V, delta-star connected, O.N. cooled, transportable substation unit. The work which the company has on hand for nuclear power stations is illustrated on two large display stands. During the period of the exhibition the centenary film "Parsons —The Genius of Power" will be shown.

A. Reyrolle & Co., Ltd., Hebburn, Co. Durham.—**Stand A.87/A.96.**—The major unit on show is a single-phase unit of a 300 kV 7,500 MVA air-blast circuit-breaker complete with its local air-receiver. Alongside the circuit-breaker there are two 300 kV post type current transformers, one of which is complete, but the other is displayed without its porcelain insulator and casing to show the internal construction of the primary and core. Another e.h.v. circuit-breaker displayed is a completely sectioned single-phase unit of a 132 kV 2,500 MVA small-oil-volume circuit-breaker. An 11 kV non-extensible combined ring-main switch and tee-off fuseswitch outdoor unit particularly suitable for rural distribution networks is also shown.

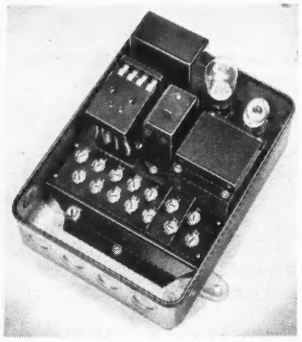
The Rheostatic Co., Ltd., Slough, Bucks.—**Stand A.99.**—Prominent on this stand are the new Satchwell "VC" thermostats for electric water heaters which embody all the essential characteristics with simplified construction. There are three new automatic controls for oil burners: the Satchwell DS is a self-contained instrument for mounting in the flue of a boiler; the DW is a similar control arranged for wall mounting and used in conjunction with a separate thermostat mounted in the flue; and the DEL fulfils basically the same functions as the other two instruments



Parsons 150 kVA mining type transformer



Right: Reyrolle 275 kV 7,500 MVA air-blast circuit-breaker



Interior of the Satchwell DEL control (Rheostatic Co., Ltd.)

but uses a photo-cell protective device in conjunction with the control unit.

Rotaflex (Great Britain), Ltd., 90, Regency Street, London, S.W.1.—**Stand A.11/A.32.**—Plastic lampshades and lamp fittings.

Siemens Electric Lamps & Supplies, Ltd., 38-39, Upper Thames Street, London, E.C.4.—**Stand A.62.**—Marine equipment on show includes bridge telegraph, rudder indicator apparatus, and navigational aids. L.v. switchgear consists of earth leakage circuit-breaker devices, cut-outs, power fuse boxes and consumer service units. Telephone equipment is represented by a 25 line P.A.X. exchange, various types of telephone apparatus such as deaf-aid and silent call equipment, master and slave clocks, a varied selection of relays and motor uniselector switches. A representative range of street lighting lanterns includes "Coventry," "Cathay," "Kuwait," "Court," "Carpenter," "Crawley" and "City" models. Fluorescent lighting fittings recently introduced are the "Congress" and the FTF. 5742 "clip-on" louvres for bare fluorescent tubes and batten fittings. Tungsten-lamp fittings and a range of "Fleurlite" decorative home lighting units are also displayed. All types of lamps, including plant irradiation lamps, complete the illumination section. A range of "Wafer" convector heaters and tubular heaters are also on show.

Smiths Clocks & Watches, Ltd., Sectric House, Waterloo Road, Cricklewood, London, N.W.2.—**Stand A.26.**—The range of "Sectric" electric clocks has been extended by the introduction of several new models, in particular wall clocks including the "Hereford," "Monmouth," "Suffolk," "Oxford" and "Dumfries" models. Among other introductions are the "Besborough" mantel clock and the "Daventry" kitchen clock. A new repeater alarm clock is the "Autocal," which is self-starting, has a luminous dial and rings alternately for 25 seconds with a five-second silent period.

South Wales Switchgear, Ltd., Blackwood, Mon.—**Stand A.33/A.56.**—On this stand is shown a selection of equipment from the company's range of switchgear and transformers, including the 33 kV outdoor, type E.O.1, oil circuit-breaker for service up to 1,000 MVA fitted with motor wound spring operating mechanism; 11 kV 500 MVA indoor metalclad switchgear with oil circuit-breakers, including the 250 MVA CX porcelain bushing breaker; and 33 kV outdoor metalclad air insulated, vertically isolated switchgear for service up to 1,000 MVA. In the l.v. field is "R" type switch fusegear for service at 400-440 V up to 400 A and from the transformer works are exhibited units up to 5,000 kVA including pole mounting types to C.E.A. T.1 specification for rural distribution.

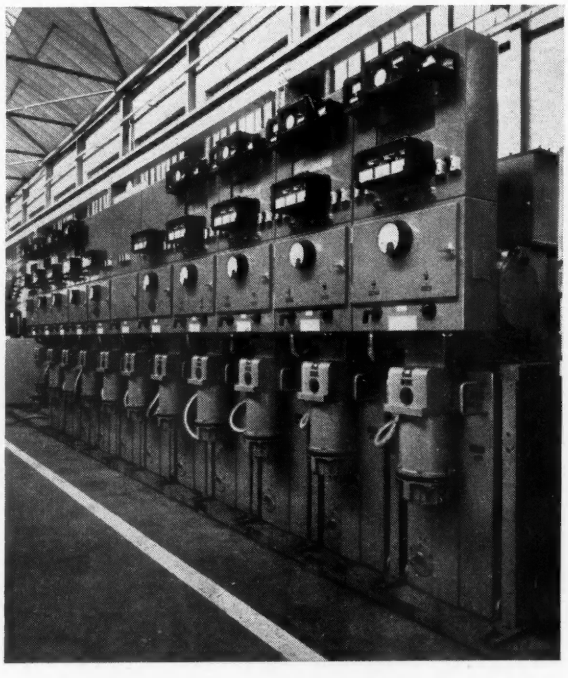
Stewarts & Lloyds, Ltd., 41, Oswald Street, Glasgow, C.1.—**Stand A.90.**—Tubular steel street lighting columns together with models of tubular steel transmission line poles. The lighting columns exemplify plain and fluted styles and demonstrate the mounting of post, pendant, side entry and fluorescent lanterns.

Bertram Thomas (Engineers), Ltd., Worsley Street, Hulme, Manchester, 15.—**Stand A.29.**—A 3 kV 1,600 A d.c. circuit-breaker interrupting short circuits under test conditions is prominent among industrial type d.c. switchgear on this stand. "Tiltrack" industrial type steel storage equipment is also displayed.

Wilkins & Mitchell, Ltd., Darlaston, S. Staffs.—**Stand A.13.**—The full range of "Servis" washing machines, with and without heater, is shown, including the new "Gaytone" range of two tone coloured models in lantern red, jasmine, horizon blue and almond green combined with white or cream. The latest "Servis" washing machine, for export markets only, is a smaller model "S" fitted with a special timer control on the front fascia of the machine. The range of export "Servis" refrigerators, of 8 cu ft (250 litre) and 4 cu ft capacities, will be exhibited, the latter representing the new "Servis" model for 1956.

Winston Electronics, Ltd., Shepperton, Middlesex.—**Stand D.24.**—Telephonic communication equipment includes the "Tellaloud" shown as a complete system with its own cabinet, or as fitted to ordinary existing handset telephones. Also to be seen is the "Adaptaplinth" for use in conjunction with a desk telephone or with any normal press button interphone system using 1, 2, 3 or 4 wires per line.

Yorkshire Copper Works, Ltd., Leeds.—**Stand A.45/A.47.**—The design of this stand has been based on a modern power station, the two chimneys being in 21in diameter polished copper tubes and arranged on the sub-floor on two sides of the main stand is a "grid substation" in "Yorkshire" high conductivity copper tubes which are regularly supplied to the electrical industry for this purpose. One large showboard shows a cluster of full length condenser tubes in "Yorcalbro," "Yorcoron," 70/30 brass, 70/29/1 brass, 70/30 cupronickel and "Yorcunic," while below these is arranged a section of a "U" tube bundle, in "Yorcunic," as used in feed water heaters.



11-panel 6,600 V 350 MVA switchboard fitted with solenoid-operated mechanisms (South Wales Switchgear, Ltd.)

EXHIBITS AT CASTLE BROMWICH, BIRMINGHAM

W. & T. Avery, Ltd., Soho Foundry, Birmingham, 40.—**Stand D.523/D.420.**—Among many weighing, counting and testing machines to be seen on this stand is an automatic tarring and drum filling scale with electronic control, designed for weighing liquids into drums to a predetermined net weight.

Bakelite, Ltd., 12-18, Grosvenor Gardens, London, S.W.1.—**Stand C.404/C.505.**—Materials on show for the first time include polyethylene and syntactic foams and in addition there are examples of "dipping," a new technique using polyester resins for protecting electronic and other components against humidity and corrosion or for insulating them. Attention of visitors is directed to the use of polyethylene as a cable dielectric, its unique insulation and low loss properties at high frequencies having contributed much to the development of deep-sea telephone cables.

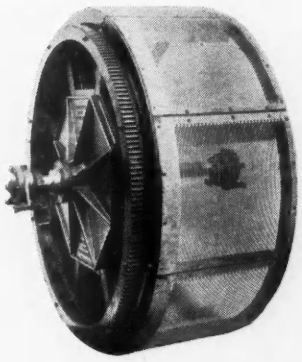
Bendix Home Appliances, Ltd., Albion Works, Kingsbury Road, Birmingham, 24.—**Stand B.517/B.416.**—The company is showing its automatic home washer which not only washes, but rinses, spin-dries and finally switches off.

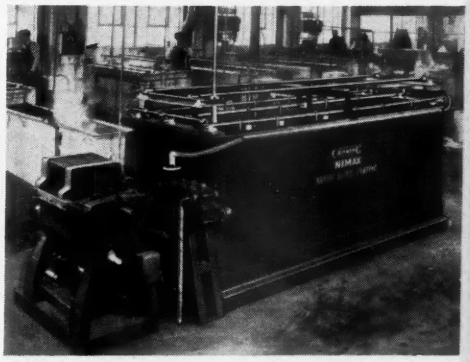
Birmingham Battery & Metal Co., Ltd., Selly Oak, Birmingham, 29.—**Stand D.514/D.615.**—Copper, brass and other copper alloy tubes, plates, sheets, strip, wire and rod are displayed, together with tubes ranging from small diameters up to 24in o/d and a series of condenser plates as rolled for British and foreign power stations and similar to those being supplied for the British atomic power programme. A subsidiary, Guests Brass Stamping Co., exhibits pressings and forgings in brass, naval brass, aluminium bronze, etc.

F. H. Bourner & Co. (Engineers), Ltd., Manor Royal, Crawley, Sussex.—**Stand D.744.**—The Mk III model "Supadynamic" cartridge operated tool incorporates several improvements. The company is showing a range of $\frac{3}{4}$in pins for the first time in addition to the existing range.

F. W. Brackett & Co., Ltd., Hythe Bridge Ironworks, Colchester.—**Stand D.430.**—An industrial size central flow band type water screen can be seen working on this stand in addition to which there are a cup type automatic water screen and several small water pumps. The company's screens are used for the continuous screening of water for power stations, waterworks, sewage outfalls and factories and more than 1,000 installations are operating in many parts of the world.

British Electrical Development Association, 2, Savoy Hill, London, W.C.2.—**Stand C.509/C.408.**—"Electricity Increases Productivity in Woodworking" is the theme of a joint exhibit in conjunction with the Midlands Electricity Board. The stand is divided into six sections illustrating the application of electricity to plant layout, processing, materials handling instrumentation and control, lighting, heating and ventilating. Working exhibits include an overhead infra-red heater and a storage block heater, while models show the components of an electric floor-warming installation.



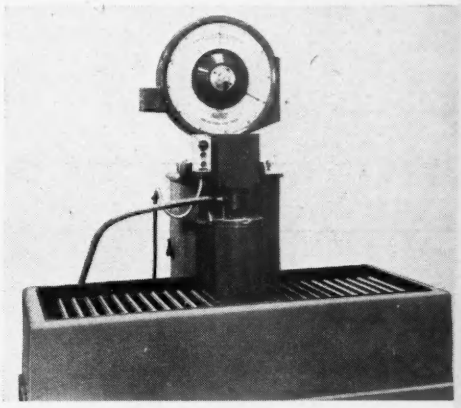


Left: F. W. Brackett & Co.'s cup type automatic water screen and (right) Canning bright nickel plating installation

British LaBour Pump Co., Ltd., Blundell Street, London, N.7.—**Stand D.339.**—A new range of "LaBour DZT" pumps, designed with a view to improving efficiency in chemical liquor pumping applications, is presented. With its new tapered open-type impeller, a smaller sized pump of lower power is claimed to achieve results hitherto requiring larger and more expensive types of pumps.

Alfred Bullows & Sons, Ltd., Long Street, Walsall, Staffs.—**Stand D.743/D.642.**—The company's stationary and portable "Hydrovane" compressors, both petrol engine and electrically driven, have capacities ranging from 3 to 250 c.f.m. per unit. A display is also devoted to the PR.303E spray painting plant and further exhibits show the range of Bullows spray guns and spray painting equipment with typical applications. There is also a 15ft waterwash spray booth running under working conditions.

W. Canning & Co., Ltd., Great Hampton Street, Birmingham, 18.—**Stand D.207/D.108.**—The main exhibit is a bright nickel plating installation. A heat exchanger enables steam or high pressure hot water to be passed through the unit whereby heat is extracted and transferred to the plating solution which passes through the exchanger in a contraflow direction. Thus a high rate of heat input is given to the solution. Other products shown are a portable plating-out unit; a "Hymax" totally submerged barrel; "Typhon" barrels; the "Victor" chrome barrel; centrifugal dryers; a rotary table polishing machine; and "Nimax" bright nickel.



Avery automatic taring and drum filling scale with electronic control

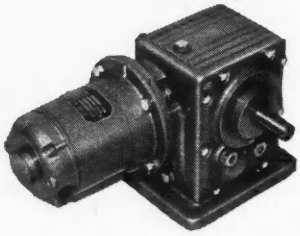
C.A.V., Ltd., Acton, London, W.3.—**Stand C.501.**—Among the generators displayed are 5 and 7in diameter models, one type being fireproof, and starters include the 6in diameter "axial" type, suitable for starting transport, marine and heavy industrial engines. Other products are control boards and combined switch, fuse and control boards, for use with generators of both compensated voltage and current-voltage type control; switchboards and switch panels covering a wide range of vehicle, marine and industrial engine requirements; lead-acid and alkaline type batteries; electric vehicle door actuating mechanism; and a waterproof searchlight.

Conveyancer Fork Trucks, Ltd., Liverpool Road, Warrington, Lancs.—**Stand D.717/D.616.**—The latest E2-20 battery-electric fork truck is a 3-wheeled model of 2,000 lb capacity at 20in load centre having controlled acceleration and dynamic braking.

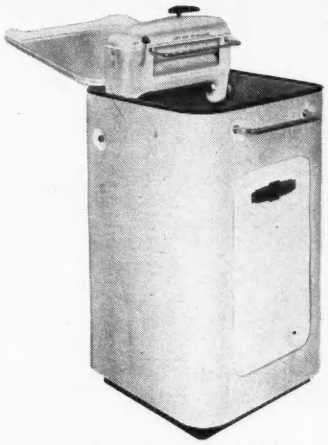
Dawson, McDonald & Dawson, Ltd., Compton Works, Ashbourne.—**Stand C.713.**—The compressor of the

Fenner "Torque-Arm" application on a grinding and mixing mill

Lamb, Hingley & Co.'s 10 gal "Apex" clothes boiler



Left: F.H.P. Motors geared motor unit type C.70



Easiclene model EW.3 heated washing machine

"Compton" DPF spraying machine has been redesigned and now has a "dry sump" with grease-packed and sealed ball bearing. Spray equipment for laundry use, oil-free air compressors, stationary and portable piston compressors, plastic mouldings and sand and gravity die castings are also shown.

Donovan Electrical Co., Ltd., 70-82, Granville Street, Birmingham, 1.—**Stand C.722.**—Apart from a.c. motor starters, power relays and contactors, the company is showing foot-operated switches, limit switches, terminal blocks, examples of a 10 A power relay up to 8-pole, "Donlok" and "Safuse" switchgear, interlocked switch plugs (available up to 100 A triple-pole), a crane safety switch, "Reylovolt" transformers and the "Runtact" overhead power duct, and examples of specially built control panels, particularly of interest to the machine tool trade.

Easiclene Porcelain-Enamel (1938), Ltd., Darlaston, South Staffs.—**Stand B.522.**—An attraction of the "Easiclene" electric washing machines is the choice of colours—red, eau-de-nil, cream, light blue and the conventional white. Duo-tone effects may be achieved by interchanging the wringers and lids to match the kitchen decor. The machines are supplied with or without 2·7 kW heaters. Among refrigerators is the Mk II family size model with useful working table top in porcelain-enamel and available in cream, white, red, eau-de-nil or light blue finish.

Electric Depot, Ltd., Pritchett Street, Birmingham, 6.—**Stand C.707.**—Adjustable local lighting fittings for all industrial applications include a dual-purpose "Lens-Aid" which combines illumination with magnification. Cable racks and hangers for supporting power cables are other specialities.

Electro-Chemical Engineering Co., Ltd., Netherby, 161, Queens Road, Weybridge, Surrey.—**Stand C.609.**—A semi-automatic barrel plating line including pre-cleaning and plating tanks and ancillary equipment is shown. The plating barrels are manufactured of specially treated "Perspex" suitable for a variety of processes. Other types of fully immersed "Efco-Udylite" plating barrels are demonstrated. A new type of metal cleaning equipment using "Efco-Di-Phase" cleaners is being increasingly used by the automobile and associated trades for removing grease, oil, etc.

Electromagnets, Ltd., Boxmag Works, Bond Street, Birmingham, 19.—**Stand C.605.**—On this stand can be seen the "Boxmag" selector load system of lifting magnet control for use in conjunction with the company's range of lifting magnets; magnetic separators, including an example of the "Boxmag" patent conveyor head equipment built into a shortband conveyor; a permanent magnetic conversion of this equipment built into a jobbing foundry sand separator; and a magnetic swarf separator.

Felco Hoists, Ltd., 29, Cromwell Road, South Kensington, London, S.W.7.—**Stand D.247/D.146.**—Triple gear chain blocks; electric chain and wire rope hoists; travelling trolleys; "Adjust-A-Leg" equalising slings; handy lifts; and patented ratchet hoists fitted with overload preventers.

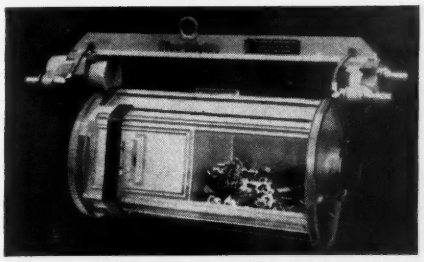
J. H. Fenner & Co., Ltd., Marfleet, Hull.—**Stand D.406.**—The success achieved by the first four sizes of shaft-mounted speed reducers, introduced twelve months ago, has created a demand for higher powered units and two larger sizes are to be seen on this stand, where "Torque-Arm" running units are also in operation.

Fescol, Ltd., North Road, London, N.7.—**Stand D.529.**—The latest development of the "Fescol" process, the direct deposition of hard chromium on any of the known light alloys, is demonstrated. The application has been used extensively by a number of industries already and a variety of treated components are on display.

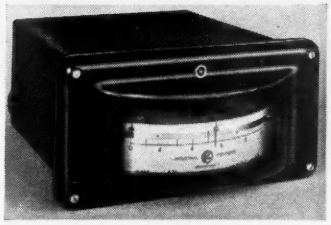
Foundry Equipment, Ltd., Linslade Works, Leighton Buzzard, Beds.—**Stand D.201/D.300.**—An electrically heated S.P. 10 shell moulding machine, "F.E.-Matic" electro-vibratory knock-out, electric sand-rammer, H.E.B.1 "Hydroil" electric boxless moulding machine and two electrically driven sand mills are shown together with ancillary items which include electric motor driven belts and elevators.

Fractional H.P. Motors, Ltd., West Heath Works, Rookery Way, Hendon, N.W.9.—**Stand C.721.**—On display is a comprehensive range of a.c./d.c. universal, shunt, split-phase, three-phase, capacitor, synchronous and shaded pole motors, ranging from $\frac{1}{250}$ to $\frac{1}{2}$ h.p. The company's latest geared unit is the C.70 which has a selection of standard output speeds from 0·125 to 12 r.p.m. with torque up to 250 lb/in.

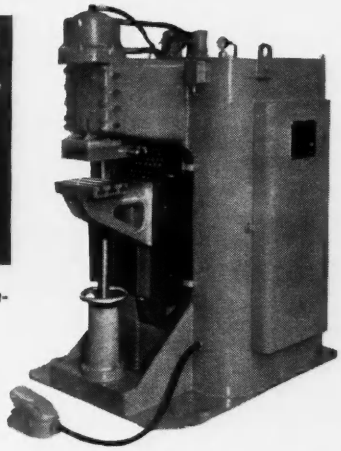
Hadley Telephone & Sound Systems, Ltd., Cape Hill, Smethwick.—**Stand C.712.**—Improvements have been made in the company's industrial sound unit and the "Multicom" intercommunication system, which is claimed to be the only equipment of its kind providing direct loudspeaking or telephone contact between all points up to a maximum of twenty. Other exhibits include the "Intercommunicator" Mk III, a new executive master unit for use with internal automatic dial telephone systems, and sound equipment for hospitals and schools. A calendar



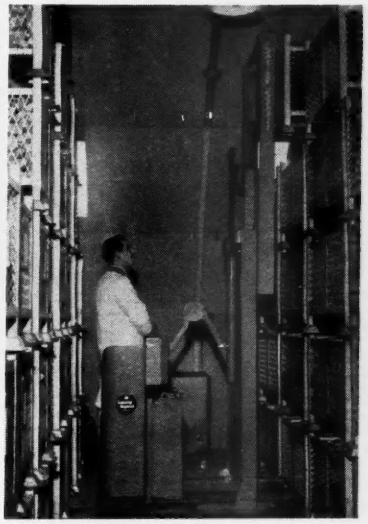
"Perspex" plating barrel (Electro-Chemical Engineering Co., Ltd.)



Left: Electronic "Pyrostat" controller (Industrial Pyrometer Co., Ltd.)



200 kVA projection welding machine (Holden & Hunt, Ltd.)



Lansing Bagnall SFR.225 stand-on reach fork truck

clock, besides telling the time, indicates the day, date and month.

Hadrill & Horstmann, Ltd., Oak Lane, East Finchley, N.2.—**Stand C.504.**—Counterpoised lamps for industrial and domestic use are displayed. Industrial lamps include table models of robust design for individual lighting in offices, factories, etc., and similar models with various fittings to suit every requirement, including a wall bracket fixture. The Horstmann adjustable lamp with telescopic extension and trolley base and the Horstmann "Pluslight" with a large rectangular lens attachment specially designed to provide an ideal combination of illumination and magnification are also shown.

Hale & Hale (Tipton), Ltd., Dudley Port, Tipton, Staffs.—**Stand D.609/D.508.**—High quality "Blackheart" malleable iron castings to top grade of B.S. 310/1947; "Permalite," a special hard-wearing metal; and castings for the agricultural, electrical, railway and shipbuilding industries.

Holden & Hunt, Ltd., Cox's Lane Works, Old Hill, Staffs.—**Stand C.620/C.719.**—The latest range of projection welding machines have nominal ratings from 100 to 300 kVA and a throat reach of 12in to the centre of the platens, which are 9in square and arranged with "T" slots to receive a variety of projection welding fixtures. Whilst the electrical and pneumatic control gears are inbuilt, they are all readily accessible for inspection, adjustment and maintenance.

Industrial Pyrometer Co., Ltd., Gooch Street, Birmingham, 5.—**Stand C.734.**—This company exhibits heat treatment and molten metal pyrometers for the metal industries, moulding machines, press controls and surface contact pyrometers for the plastic, rubber and allied industries, multi-point pyrometers for diesel engines, paint drying ovens, etc. Recent developments include the design of electronic controllers.

Izons & Co., Ltd., Albion Works, West Bromwich.—**Stand A.520.**—Grey iron castings for the electrical trade and cast iron utensils with machined bases for use on electric and other hot plate cookers.

J.P. Engineering Co., Ltd., Meynell Road, Leicester.—**Stand A.425.**—Lawn-mower exhibits include the "Monarch" and "Maxees" models, powered to drive the cutters only, and the "Super" electric lawn-mowers, which are entirely self-propelled.

Keith Blackman, Ltd., Mill Mead Road, Tottenham, London, N.17.—**Stand D.726.**—Fume removal fans, all with solid, rigid p.v.c. casings and impellers, include a 10in bifurcated fan with divided casing and motor chamber isolated from the possibility of corrosive attack by chemical fumes exhausted through the casing; a series I open paddle bladed fan with a 12in impeller; and a series II multivane centrifugal fan from the range with impellers from 15in to 42in diameter. Among other fans are the three-bladed type APA propeller fan; the N.00 blower for smithy blast, air supply to oil fired furnaces, etc., and the "Keith" centrifugal fan for forced draught to boilers, and for fine dust and fume removal.

W. Kennedy, Ltd., Station Works, West Drayton, Middlesex.—**Stand D.766.**—Bending machines of all types for the electrical and engineering industries; pipe benders, bar benders for ferro-concrete reinforcement, etc.; and the "Kennedy" portable power hacksaw.

Lamb, Hingley & Co., Ltd., Stour Works, Lye, Stourbridge, Worcs.—**Stand A.433.**—In addition to the "Apex" 4 gal electric clothes boiler the company has a new 10 gal heavily galvanised model with a 2½ kW element, automatic cutout, press button on/off switches and draining tap.

Lansing Bagnall, Ltd., Kingsclere Road, Basingstoke, Hants.—**Stand C.727/C.628.**—Demonstrations of all the basic models in the company's range of materials handling trucks show visitors to this stand economical methods of moving different palletised and unpalletised loads. Many refinements have been introduced and pride of place is given to the SFR.225 stand-on reach fork truck. Retraction of the complete mast and fork assembly, with load, inside the wheelbase for travelling and manœuvring enables this truck to handle 40 by 40in pallets in aisles no wider than 5ft 6in and 2,500 lb loads can be lifted and stacked to a height of 10ft. Ease of handling has been sought in the new control layout, which incorporates a direction indicator dial in the centre of the one-hand steering wheel. The PF series of pedestrian controlled electric fork trucks are represented by fixed and tilting mast models.

Liverpool Electric Cable Co., Ltd., 24, Queen Anne's Gate, London, S.W.1.—**Stand C.717.**—Electric cables and flexibles (rubber, thermoplastic, paper and cambric insulated) for mines, quarries, railways, ships, and house and domestic wiring.

London Electric Wire Co. & Smiths, Ltd., 24, Queen Anne's Gate, London, S.W.1.—**Stand C.717.**—Insulated electric wires, strips, and strands with cotton, silk, paper, asbestos, glass, enamel and "Lewmex" coverings; fire resisting cords and flexibles; and copper braids and cords.

Joseph Lucas, Ltd., Great King Street, Birmingham, 19.—**Stand C.501.**—Electrical equipment for vehicles

includes the new "Beamsetter," a road safety device for testing of car headlamps; the "Screenjet," an electric motor-driven car-screen washer; "SR" magnetos; trafficators; batteries; and horns.

McKechnie Brothers, Ltd., Rotton Park Street, Birmingham, 16.—**Stand D.500.**—Extruded rods and sections in brass, bronze, nickel silver and copper; brass, bronze and aluminium stampings; sulphate of copper, electrolytic copper powder, copper cathodes and "Lithopone"; and "Spider Brand" and other solders.

Marris's, Ltd., Cumberland Street, Birmingham, 1.—**Stand A.330.**—Electric kettle suitable for operation from a car battery, and electric shaving mirrors.

M.C.L. & Repetition, Ltd., Pool Lane, Langley, Birmingham.—**Stand D.414.**—Repetition parts for a wide variety of trades, including the motor, aircraft, radio and general electrical industries.

Murex, Ltd., Rainham, Essex.—**Stand D.641/D.540.**—In addition to metals such as molybdenum, tungsten, tantalum and zirconium, the company is now producing niobium both as a metal powder and in fabricated form. Niobium, which was previously known as columbium, is of importance for use in atomic energy reactors.

Nutt Engineering Co., Ltd., Norwich Street, Cambridge.—**Stand A.319.**—"Hayn" electric lawn mowers in 12 and 18in sizes.

W. H. Paul, Ltd., Breaston, Derby.—**Stand B.329.**—Stainless steel kitchen equipment and the "Wash Wonder," an electric washing machine built into a sink unit and permanently connected with the domestic water supply and waste outlet.

Permali, Ltd., 125, Bristol Road, Gloucester.—**Stand C.615/C.514.**—"Permali," "Permaglass" and "Hydu-lignum" are shown in a variety of applications for general engineering, chemical and electrical uses. These include a selection of machined components and assemblies for electrical plant and equipment; "Permali/Spruce" operating poles, sectioned for portability; staywire insulators; and "Dialam" condenser bushings for voltages up to 69 kV and including 33 kV cable box bushings to the new standard C.E.A. specification.

Phœnix Sales, Ltd., Winton House, St. Andrew Street, London, E.C.4.—**Stand A.609/A.504.**—"Jet Power," "Power-Flo," "Gloria," "Major," "Popular" and "Clipper" domestic vacuum cleaners.

Pytrotenax, Ltd., Hedgeley Road, Hebburn, Co. Durham.—**Stand C.720.**—Exhibits show the use of "Pyrotenax" cable for rising and lateral mains, for street lighting and for internal wiring using preassembled cable units cut to length and sealed at the factory and ready for immediate installation on site. Other exhibits include thermocouples, compensating cables and heating cables; a roller straightener for the smaller diameter cables; and a new light alloy thermocouple head which has right-angle entry, connections being made by means of porcelain terminal blocks.

Ransomes, Sims & Jefferies, Ltd., Orwell Works, Ipswich.—**Stand A.502. Outdoor 1317/1216.**—A selection from the company's battery-powered industrial trucks includes forklifts, platform trucks, crane trucks, tractors, etc. The "Forklift 10" has a normal load capacity of 1,120 lb, at 15in centre, and the load is automatically clamped when lifted. The "Forklift 2000" is claimed to represent a great advance in lift truck equipment, providing simultaneous and individual control of the load arms, and automatic maintenance of gripping pressure all the time a load is carried.

Rapid Magnetic Machines, Ltd., Lombard Street, Birmingham, 12.—**Stand C.421.**—Equipment exhibited includes a new self-cleaning rotary type magnetic extractor incorporating a diverting scroll; a 20in diameter lifting magnet which handles different shapes and sizes of steel; a new self-cleaning "Ejecta" plate magnet; the "Permalift," recently introduced to help solve the problem of container handling; and a tramp iron diverter unit. A portable foundry separator is available for inspection and an example of a new suspension magnet technique is also exhibited.

Rover Co., Ltd., Meteor Works, Solihull, Birmingham.—**Outdoor 1352.**—The Rover 1S/60 single shaft gas turbine is said to be the first small gas turbine in production in this country. Generating sets demonstrate clearly the advantages of low weight and compactness that are obtained when using the gas turbine as the prime mover.

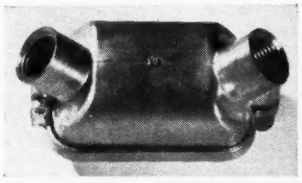
William R. Selwood, Ltd., Chandler's Ford, Hants.—**Stand D.758.**—Claimed to be the lightest, simplest and cheapest 2in diaphragm pump yet produced, the "Simplite" pump will deliver up to 1,600 gal of water an hour and combines the advantages of both the centrifugal and diaphragm types. All the main castings are of a special grade of aluminium alloy and the total weight is only 98 lb. Hand operated, electric and petrol models are shown.

Serck Radiators, Ltd., Warwick Road, Birmingham, 11.—**Stand D.618.**—A number of smaller primary and secondary surface heat exchangers are exhibited, photographs illustrating larger units and the range of applications of Serck equipment. With considerably augmented production facilities, Serck Tubes have a greatly increased output of solid drawn non-ferrous condenser tubing.

Frederick Smith & Co., 24, Queen Anne's Gate, London, S.W.1.—**Stand C.717.**—Bare copper, cadmium-copper, bronze and copper alloy rods, wires, strips, strands, sections and forgings; power, trolley and telephone line wires; tin and silver plated copper wires and strips; aluminium wire and strand; and aluminium alloy strand for power transmission lines.

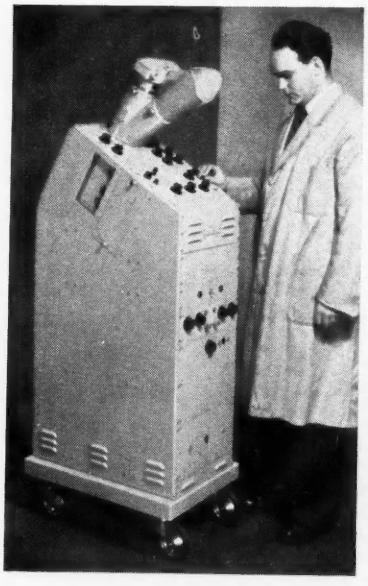
Southern Instruments, Ltd., Frimley Road, Camberley, Surrey.—**Stand C.603.**—Among oscillograph recording equipment and other electronic apparatus on view are an ME 109 engine indicator; ME 122 two-channel engine indicator; M 972 general purpose oscilloscope; M 974 four-beam oscilloscope; TR 12 transient recorder; M 926 recording camera; M 731 universal camera; M 906 drum camera; and transducers for measuring pressure, force, vibration and acceleration. New equipment includes an M 732C auto-developer designed for processing oscillograph records under daylight conditions without a darkroom.

Spiral Tube & Components Co., Ltd., Osmaston Park Road, Derby.—**Stand D.710.**—Among a wide range of air heating equipment are the electrically operated "Spiraluxe" Mk II unit heaters manufactured in 2 or 3 kW loadings, wall mounting or portable



Light alloy thermocouple head (Pyrotenax, Ltd.)

Southern Instruments TR12 transient recorder



models, especially designed for offices, board rooms, canteens, etc. The recently introduced electric range of unit heaters in 2 or 3 kW loadings have been specially designed for shops, drying cupboards, etc., and are available with or without remote control. One of these units is fitted on the stand and can be seen in operation by a remote control push-button switch.

W. & S. Summerscales, Ltd., Parkside Works, Keighley.—**Stand A.521.**—Of four new "Scales" washing machines, the S.1, S.2, SH.3 and SH.4, the last two are fitted with 3 kW heaters. A time switch is fitted in the S.2 and SH.2 models.

Taylor & Challen, Ltd., Derwent Works, Birmingham, 19.—**Stand D.415.**—Presses exhibited by this company include the 1431 screw press for the rapid production of hot brass stampings; the 576 double roll feed press of 20 tons capacity, an open-fronted inclinable press fitted with double roll feed gear and arranged for motor drive from a 3 h.p. motor running at 960 r.p.m., to give 50 strokes/min through single gearing; and the 1522 notching press for notching stator laminations, either in ring or segment form. The last mentioned has a 2-speed motor giving speeds of 280 and 350 strokes/min. Typical stator laminations are being exhibited.

Herbert Terry & Sons, Ltd., Redditch.—**Stand B.424.**—"Anglepoise" lamps for home, hospital, office and workshop use; cable clips, neon tube clips, flexible shaft outfits, etc.

United Ebonite & Lorival, Ltd., Little Lever, near Bolton, Lancs.—**Stand C.301.**—On this stand emphasis is placed on liquid depolymerised rubber (Lorival "R") and the compounds (Lorival "CR") derived from it. It is available in various viscosities and can be used as a rubber processing agent; to impart "cling" to lubricants; as a master-batch medium for paints, dyes and inks; for corrosion-resistant coatings; and as the basis for a wide range of liquid compounds which can be poured at room temperatures and cured to produce rubber castings with any required degree of hardness. Mouldings, extrusions and fabrications in a wide range of materials including polythene, p.v.c., acetate and polystyrene, urea, phenol-formaldehyde and hard rubber complete a comprehensive display.

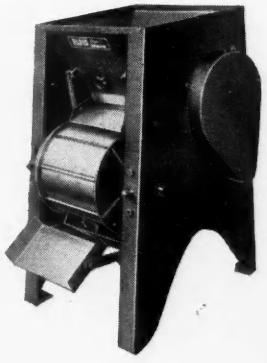
Vactite Wire Co., Ltd., 24, Queen Anne's Gate, London, S.W.1.—**Stand C.717.**—Resistance wires and tapes in "Vacrom" (nickel-chrome) and "Eureka" (cupro-nickel); molybdenum rods, wires and tapes; pure nickel and special wires for the electric lamp and radio valve industries.

Veeder-Root, Ltd., 20, Purley Way, Croydon, Surrey.—**Stand C.740.**—Among four new products recently developed is a reserve counter, a small electrically operated unit with a novel form of presetting specifically designed for use on aircraft. New counters specially developed for use on tape recorders are also on view.

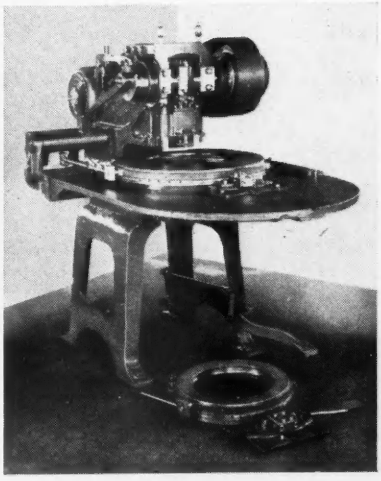
Walker Fender Co., Ltd., Despatch Works, 27, Alcester Street, Birmingham, 12.—**Stand A.331.**—Table, floor and bridge lamps, including contemporary types.

H. C. Webb & Co., Ltd., Tame Road, Witton, Birmingham, 6.—**Stand A.511.**—The company's range of lawnmowers includes two electrically propelled models in 12 and 14in sizes.

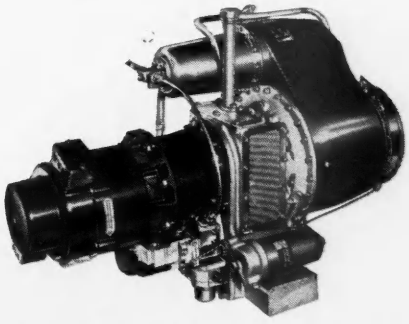
Westinghouse Brake & Signal Co., Ltd., 82, York Way, King's Cross, London, N.1.—**Stand C.508.**—The Rectifier Division exhibits special "Westalite" equipments including the "Westculite," a new water cooled rectifier developed for electro-deposition and allied processes. Battery charging equipment, particularly for electric vehicles, is also shown, and there are working exhibits showing examples of a new range of pneumatic control equipment and a working model of the Westinghouse system of mine traffic control for underground locomotive haulage roads.



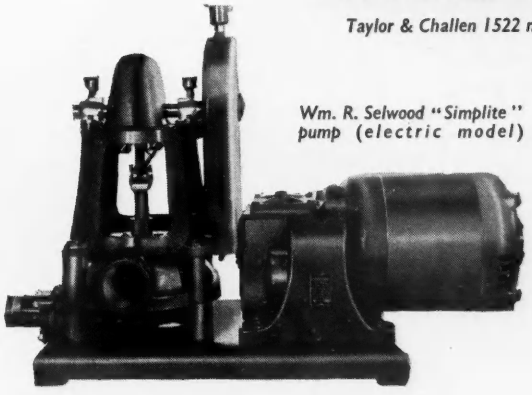
Type JYP separator (Rapid Magnetic Machines, Ltd.)



Taylor & Challen 1522 notching press



Gas turbine powered Rover-Rotax generating set



Wm. R. Selwood "Simplite" pump (electric model)

Right: Ransomes "Forklift 2000"

Farm Electrification Courses

THE Merseyside and North Wales Electricity Board held its second annual staff training course on farm electrification at the Flintshire Horticultural Institute, Northop, from 3rd to 7th April. Attended by twenty of the Board's commercial staff who specialise in advising upon and selling electrical apparatus for agricultural purposes, the course was designed to give up-to-date knowledge of farms' requirements and problems.

At the opening ceremony Mr. D. H. Kendon, chairman of the Board, stressed the importance of selling electricity to the farming community and suggested that the most facile approach was through the farmhouse. Lighting was the first essential in selling to the farmer, followed by cooking and water heating. After this approach, the selling of electrical power equipment to help in the farmyard would be a natural conclusion. Mr. Kendon also urged the staff to study the problems of the agricultural world and to be on the look-out for new and improved methods of harnessing electrical power to farm machinery.

Mr. J. A. Duncan, a member of the Merseyside and North Wales Electricity Board, himself a Cheshire farmer, stressed the point of view that hill farming in North Wales was limited in its possible use of electricity, but recent figures showed that consumption was increasing. Mr. W. E. Jones (deputy director of the National Agricultural Advisory Service in Wales) spoke on general problems of farm management and said that physical increase in production was no longer necessarily the means of increasing profitability. To-day the Government expected the farmers to absorb some of the rising costs of production.

The course included practical demonstrations and inspections of local farms and in the evenings there were discussion groups, open forums and film shows illustrating some of the academic instruction given during the day. The speakers included several of the National Agricultural Advisory Service district and specialist officers, agricultural specialists from the North Western and Midlands Electricity Boards and Mr. P. Wakeford, agricultural advisory specialist from the Central Electricity Authority. Mr. T. R. Smith (Manweb assistant commercial officer) was responsible for the arrangement of the course.

High Voltage A.C. Traction

FUNDAMENTAL advantages of high voltage a.c. electrification at standard frequencies compared with d.c. techniques were explained by Mr. G. H. K. Lund (assistant to the chief operating and motive power officer, British Transport Commission Railways Division) in a paper, "Future Developments in Motive Power," given in Liverpool on 5th April.

Mr. Lund said the decision which had faced the B.T.C. was whether to adopt the 25 kV a.c. system which still had considerable technical problems to be solved as well as involving the conversion of existing overhead d.c. systems to a.c. Future prospects gave every indication that greater economies and technical progress would more than offset the immediate difficulties and with the lower cost of a.c. electrification it would become an economic possibility to electrify certain lines which could not be considered for electric traction under the d.c. system.

A.c. electrification would mean (a) considerably reduced costs in the power supply; (b) substantial savings in both copper for the contact wire and steel for the overhead structures; and (c) fewer locomotives would be needed and no power wasted in speed control resistances.

In order that reasonably accurate comparative costs should be available, a survey was made over the Euston-Manchester and Liverpool lines and detailed estimates were obtained for both the high voltage a.c. and the d.c. systems. One of the disadvantages of a very high voltage system was that more clearance was required between the contact wire and the surrounding structures or rolling stock.

On the route from Euston there were 904 overbridges and of these 478 would require raising to obtain the 4in clearance needed for d.c., while 701 required lifting to obtain the 11in clearance necessary for the 25 kV a.c. Where it was impracticable to obtain 11in clearance it was proposed to reduce the line voltage to 6·6 kV for which 4in clearance would be sufficient, and arrangements could be made at the locomotive power units for an automatic change-over when passing to or from a section of different voltages.

The total cost of providing the clearances was estimated to be about £6,000,000 for the 1,500 V d.c. compared with £9,000,000 for the proposed a.c. system. By using the 25 kV a.c. system it was estimated that the Euston-Liverpool-Manchester lines would require only 12 substations to carry a maximum load of about 90 MW.

By contrast, if 1,500 V d.c. were used no fewer than 70 substations would be required and these would have to be supplied by a lengthy 33 kV cable system. The choice of voltage and the spacing of substations determined the size of overhead wires. For the d.c. system a cross-sectional area of almost 0·75 sq in would be required, whereas with the a.c. system 0·25 sq in was adequate. The saving amounted to 27,000 tons of copper and 16,000 tons of steel.

Mr. Lund said that the technical developments which had permitted the adoption of very high voltage a.c. for electrification might mean that electrification would proceed faster once it had started than was envisaged, and also that lines which could not economically justify electrification would now be electrified.

One of the most important advantages of an electric locomotive was its almost unlimited power. This was because it could draw, at any rate for a short period, from the enormous capacity of the supply network.

Imitation of Mentality

LECTURING at the Royal Institution recently, Dr. W. Grey Walter, M.C., Sc.D., Director of the Physiological Department of the Burden Neurological Institute, Bristol, explained that in spite of the wealth of information about human brains gained by study of their electrical behaviour, hypotheses relating brain function and mentality had proved relatively infertile. Those based on verbal statements lacked the rigour which provoked experimental test, while those in mathematical form tended to be unintelligible to experimentalists. In an attempt to avoid this dilemma, notions about the mechanisms of nervous action, reflexive action, instinctive behaviour and learning by association had been embodied in simple working models.

The models of reflexive behaviour and of learning by association were particularly instructive. The first, a small mobile machine resembling a tortoise in appearance, had only two artificial "nerve cells" in the form of radio valves and relays (whereas the human brain contained ten thousand million living cells) and was perhaps the simplest mechanism that could be expected to behave like a rudimentary animal. It differed from machines intended to extend human faculties (such as motor cars or electronic computers) not only in its extreme simplicity but also in its tendency to explore the world and to seek certain limited goals (moderate light) and to avoid extremes (obstacles and bright lights).

Groups of such synthetic creatures could form elementary societies and "feed" themselves on electric current. They demonstrated that certain basic aspects of mentality might arise from the interaction of a number of simple elements, provided that these were free to become interconnected in a variety of patterns. The model of learning was rather more complex, but contained only three valves. Its design was based on the hypothesis that the simplest form of association involved seven stages of operation, and that an animal capable of forming new behaviour patterns as the result of experience was continually estimating the probabilities of its various experiences being linked by more than chance. One of the inferences from these experiments was that conjecture and imagination might be more fundamental than logical reasoning in the development of mentality.

The Exhibition Question

Future of the British Industries Fair

ANSWERING questions in the House of Commons last week Mr. A. R. W. Low, Minister of State, Board of Trade, said that the number of exhibitors in the London section of the British Industries Fair had fallen from 2,153 in 1947 to 600 last year and the number at Birmingham from 1,012 to 979. The number of overseas buyers' badges issued at Birmingham was 1,534 in 1947 and 2,439 in 1955; there were over 3,600 in 1950 and 1951.

Mr. A. G. Bottomley asked the Minister whether the Exhibitions Advisory Committee had been consulted before it was decided to close the London section. Mr. Low said that there had been no consultation with the Committee but the directors of British Industries Fair, Ltd., whose chairman was a member of the Committee, had been consulted. He did not think it necessary now to obtain the views of the Committee. Mr. Bottomley asked why the President of the Board of Trade, in making his announcement, had said the number of exhibitors in London was declining when the manager of that section had said that the number was on the increase. Mr. Low said a large decline had set in in 1948 and had steadily continued.

The second, and last, issue of the *B.I.F. Bulletin* produced by B.I.F., Ltd., says that in the 1956 London sections of the Fair there will have been 120 more exhibitors than in 1955. For 1957, because of requests by additional sections of industry, the company had planned three Fairs in London alone. The comment concludes:—"We sincerely hope that a successor will put new power into the export drive and keep alive the B.I.F. motto of 'Salesmanship through showmanship.'"

In our last issue we published a letter from Mr. W. Percy McGeoch, chairman of the B.I.F. Electrical Exhibitors' Committee, who deplored the timing of the announcement of the Government's decision to withdraw support from the Fair. Mr. McGeoch asks us to make it clear that his Committee is not only looking after the interests of London electrical exhibitors but is continuing to represent those at Birmingham as well.

Our leading article this week puts forward a number of considerations which must be taken into account in deciding what part the electrical industry shall take in future Fairs. We have received the views of a number of people intimately concerned with this subject and they are reproduced below:—

Mr. Leslie Gamage, M.C., president of the Institute of Export, says:—

"The Government's action in suddenly withdrawing its support from the British Industries Fair is too drastic. Surely a little more time could have been granted to show whether under the new management the B.I.F. could have been turned into a success. It was obvious that the new management was inheriting a declining concern. It was too much to expect that the decline could be arrested and the B.I.F. restored to full and vigorous health in the time allowed. The failure of the B.I.F. as a national shop window underlines the urgent need on the one hand of a definite long-term policy by the Government on the recognition and support of a limited number of exhibitions at home and overseas, and on the other hand of industry fully and adequately representing itself at these exhibitions.

"In my view there are too many exhibitions both at home and overseas. The result has been that, owing to the lack of funds required to support so many, our impact as a leading industrial nation has been seriously weakened. There are, of course, certain overseas exhibitions which we should support, particularly those at which other industrial countries are strongly represented, but the help which the Government has given on these occasions has been so limited that its lack at recent exhibitions, at Delhi and Karachi, for example, called forth serious criticism.

"If a really representative national exhibition is to be organised at home, two fundamental requirements must be met. First, an adequate exhibitions building, such as those at Toronto and elsewhere, must be provided in or near London where ample hotel accommodation is available. As such a building does not at present exist in London it would have to be built. Secondly, the Government must give it full support for all time just as they do for the British Council. With these facilities, with good publicity and with a first-class display of the nation's industrial goods, a successful exhibition would be assured. It would afford opportunities for the large number of overseas customers, who would be certain to be attracted by an exhibition on such a scale, to inspect our works and it would enable our technical people and designers to make valuable personal contacts. The electrical industry, I am sure, would play its full part, along with other industries, in such a venture."

Sir John Dalton, M.I.E.E., chairman, W. T. Henley's Telegraph Works Co., Ltd., writes:—

"I do not know whether the Government consulted the electrical or any other British industry before deciding to end the London Section of the B.I.F. The alternative proposal to devote the Government's £100,000 to overseas fairs is bound to be ineffective by reason of the paucity of the sum.

"My own view is that we have to face up to an industrial exhibition if only because our competitors in other countries find it worth while. However, a more useful approach to the whole subject might be for a controlling body (the B.I.F. or the F.B.I.) to sponsor more elaborate exhibitions over a three- or five-year cycle, e.g. first year, Engineering Industry; second year, Shipbuilding; third year, Textiles, etc.

"Government financing and overseas publicity could perhaps then be utilised on a more productive basis and manufacturers would be able to economise their money and efforts and, at the same time, present their displays for export with a greater impact."

Mr. Stanley F. Steward, C.B.E., managing director of the Lancashire Dynamo Group, says:—

"Electrical manufacturing is one of our leading export industries and I believe that a really large electrical exhibition could, with advantage, be held in London occasionally, say, every three years. If this exhibition could be linked with a British Electrical Export Convention it could be designed to attract overseas agents and buyers from all over the world. It would be for consideration if such an exhibition could be linked in some way with any existing electrical exhibition arrangements, but the main purpose would be to focus attention on the importance of British electrical exports.

"By having a form of export convention associated with the exhibition many electrical manufacturers would be able

to use the opportunity to bring their overseas agents and customers up to date in connection with their products and, given suitable arrangements for publicity, it should be possible by this means to stimulate interest overseas in the export of electrical plant and machinery."

Mr. H. O. Missenden, general manager of the Birmingham Section of the B.I.F. writes:—

"The closing of the London Section of the B.I.F. will open a new chapter of the British Industries Fair in Birmingham. All the facilities necessary for the staging of a large and successful National Fair exist at Castle Bromwich and the Management Committee intend to carry on the B.I.F., as a whole, with the support of industry, to provide a shop window for all British manufacturers.

"The Birmingham civic authorities will give their fullest support, and the expansion of the entertainment programme, which has been embarked upon this year, will be continued in 1957 to provide attractive leisure-hour amenities for visitors and exhibitors. The blessing of H.M. Government is assured, as are the services of the overseas officers—commercial counsellors, trade commissioners, etc. Substantial home and overseas publicity will be provided.

"Inquiries for space at the 1957 Fair have already been received from individual manufacturers and trade associations."

Mr. Kenneth Horne, managing director of British Industries Fair, Ltd., tells us that although the Government has withdrawn its recognition of his company he is trying to obtain support from industry to finance a full-scale London International Fair. He says that, while the Birmingham Chamber of Commerce has undertaken to continue the B.I.F. in Birmingham, the B.I.F. as such will not be seen again in London. Mr. Horne reports that progress is being made but it is much too early to say what financial support has so far been promised.

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Power Station Efficiencies

YOU recently published the station efficiencies of the Central Electricity Authority power stations and drew attention to the fact that two stations formerly in the list of the best 20 stations were not included since they now come under the South of Scotland Electricity Board. Your readers will no doubt be interested to have a complete list for the country, and I give below a list showing the thermal efficiencies for 1955 for the best stations operated by the South of Scotland Electricity Board: Portobello H.P., 31·53 per cent; Braehead, 29·25 per cent; Clyde's Mill H.P., 26·40 per cent; Dalmarnock H.P., 24·02 per cent; Clyde's Mill I.P., 22·69 per cent; Yoker H.P., 22·44 per cent; and Bonnybridge H.P., 20·97 per cent.

The average efficiency for all stations operated by the South of Scotland Electricity Board was 24·74 per cent in 1955. This compares with a figure of 23·86 per cent for the stations in this District operated by the former South West and South East Scotland Divisions in 1954. You will see that Portobello H.P. and Braehead are among the ten best stations in Great Britain, while Portobello H.P. retains its position as the most efficient station.

The amount of coal saved due to the improvement in average efficiency was approximately 95,000 tons for the nine months from 1st April, 1955, to 31st December, 1955.

Glasgow. J. MEEK,
Secretary,
South of Scotland Electricity Board.

Railway Modernisation

YOUR account (23rd March) of Sir Brian Robertson's address is interesting in that it exposes the conservative ideas of British Railways in regard to electrification. Undoubtedly they feel very bold and enterprising in their decision to adopt the 50 c/s a.c. system.

It obviously has been well drilled into Sir Brian that electrification is only justified when the traffic is dense. This is true for what might be termed full-scale heavy electrification. A little while ago, and no doubt it still holds good, British Railways said it needed "x" million rolling ton miles per annum to justify electrification. I have forgotten the figure "x" but it was a high one. Presumably passengers were included in "x" at some average weight of perhaps 10 stones each; otherwise how did they arrive at their basic figure of ton-miles?

Where electrified systems carry passenger traffic almost exclusively, as on the "Southern," it is difficult to see how they apply the formula. Perhaps the difficulty of application is resulting in the diesel coach being so largely adopted instead of the electric passenger coach.

Electrification can be adopted for comparatively light passenger traffic, provided British Railways can get out of their minds the belief that electrification must always be of the heavy type. A great many of the branch lines that do not now justify steam operation could be converted at little cost to electric tramway cum light railway operation of the Belgian type as shown in the illustration, page 508 (6th April), of the article by Mr. R. D. Reynolds. The heaviest cost of a tramway or light railway is in the tracks which in this case already exist. Operating costs would be kept low by issuing tickets on the car. In very light traffic areas one-man operation would be adequate; signalling and manned stations would be quite unnecessary; loading platforms would meet requirements.

Is it beyond the imagination and ability of British Railways to think in terms of this light type of electrification? It is done in other parts of the world.

London, N.W.2. J. FAULKNER.

Earth Loop Testing

DR. TAGG contributes to the correspondence on the subject of earth loop testing in your issue of 13th April and mentions some of the difficulties in designing a practical and accurate test set which will accommodate the neutral-earth voltage under any conditions of phase and amplitude. The suggestion is made that instruments which can accommodate these conditions without loss of accuracy are not available.

This is not the case; readers who are interested in this subject may remember that a detailed description by the undersigned of a suitable instrument, which has been used on circuit since 1951, was published in the *Electrical Review* of 17th February this year.

Oxted, Surrey. A. J. BAGGOTT.

VIEWS on the NEWS

By REFLECTOR

WRITING in *London Electricity*, Mr. H. S. Petch gives some impressions gained during a visit to Hungary. Two items in his article particularly interested me. Mr. Petch says that, except industrially, electricity is used for little beyond lighting. The block tariff is remarkable: the first block is cheap (4d per kWh) and is intended to cover consumption for lighting in a workman's house or flat. The next block, regarded as a luxury, costs a shilling per kWh. This is what I would call a demotional tariff of a kind which some people in this country would like to be adopted here. Mr. Petch inspected a meter factory and he says:—

> "Although these meters have imported British magnets, their quality is below the standard acceptable here. Many go for export to the Middle and Far East. The meters sell for £7 in Hungary, but the identical articles are sold in Holland for £2 and in Egypt for £1 2s 6d. The Hungarian authorities say they remain accurate for six years—we can get at least 15 years from ours."

Discriminating buyers would suspect that the low prices mentioned covered a multitude of shortcomings but unfortunately buyers are frequently undiscriminating.

* * *

Mr. Thomas Atherton (who writes from the Ordsal Electrical Works, Manchester) complains in the *Manchester Guardian* of the unpunctuality of British trains and quotes examples to prove his point. I notice that these examples all relate to steam locomotives which are nowadays subject to all kinds of troubles. One of the great benefits which electrification brings is up-to-time running as anyone who uses the Southern Region system will know. I recall that in the special railway electrification issue of the *Electrical Review* in May, 1954, Mr. S. W. Smart, superintendent of operations in the Southern Region, said that in four weeks in the April of that year the average late arrival of 114,691 electric trains run on weekdays was 0·61 minute. He went on to say:—

> "During this period nearly three million electric train-miles were run and the delays attributable to electrical defects were as follows:—Train defects, 826 minutes or 0·78 per cent of total delay; current supply defects, nil."

* * *

My notes of 13th January included an account of a London Electricity Board consumer who had an electric fire installed in his bathroom by the Board and later had the work condemned by an inspector from the Board. In *The Times* of 10th April another customer of the London Board related a closely similar experience. He paid £6 11s 2d to have an extra point installed; *two* inspectors examined the work and found that it was not earthed. He said that the inspectors "appeared a little crestfallen" when they found that the job had been done by the Board's own men and he wondered whether if they had known this beforehand the point would have been passed as satisfactory. I do not think that it would for, as I said in my previous note, such cases may demonstrate the complete impartiality of the inspection department and its total independence of the installation department. However that may be, it all looks rather odd to a consumer and should not be allowed to occur.

In a reply to this letter Mr. S. Morton Gore, secretary of the London Electricity Board, deprecated the suggestion by the correspondent, saying that the Board's inspectors insisted on immediate attention to wiring defects whether the work had been done by a private contractor or the Board's staff. In this case the men responsible had been reprimanded for assuming that the installation was properly earthed.

* * *

A reader of *Northern Lights* (the magazine of the North West, Merseyside and North Wales Division of the C.E.A.) asked in the last issue whether the possibility of using CO_2 for stimulating photosynthesis in crops had been considered and suggested that it might be a commercial proposition for power stations in rural areas. The Divisional Controller (Mr. A. R. Cooper) replied that a power station chimney, which emitted both water vapour and CO_2 would seem to provide an ideal stimulant for plant growth. He said that in experiments carried out under controlled conditions some simple forms of plant life had reproduced themselves in twenty-four hours. He gave a warning, however, that the matter was more complicated than appeared at first sight. It would indeed be an achievement if power station emissions, which hitherto have been cursed by farmers, could be usefully employed on their behalf. No doubt the complications alluded to by Mr. Cooper include grit and sulphur which, however diminished by treatment of flue gases, would still be unwelcome.

* * *

Fifty years ago "municipal trading" was beginning to be a bugbear to electrical contractors and I am sure they would never have approved a move such as that suggested in the following report in the *Electrical Review* of 20th April, 1906:—

> "Municipal Free Wiring.—A special meeting of the Brighton Ironmongers' Association and electrical engineers of the town was held on April 10th, to consider a resolution which was passed by the Council on Thursday, April 5th, in favour of the introduction of a Bill into Parliament authorising all municipal Corporations carrying on electrical undertakings to wire consumers' premises. It was unanimously resolved that steps should be taken to induce the Corporation to withdraw the proposed application. The following were the principal reasons given for opposing it:—1. That municipal trading, as opposed to private trading, is a serious mistake from a ratepayer's point of view. 2. That, although the chairman stated in the Council that the proposal had met with the approval of the wiring contractors, this matter had never been put before them, and they were all very much opposed to the Corporation interfering with private enterprise in any way."

PERSONAL AND SOCIAL

News of Men and Women of the Industry

Sir Henry Self, K.C.B., K.C.M.G., K.B.E., deputy chairman (administration), Central Electricity Authority, has been awarded the degree of Ph.D. in the Faculty of Science (History and Philosophy of Science) of London University.

The A.E.I. Lamp & Lighting Co., Ltd., announces the appointment of the first two of the six managers who will be in charge of lamp and lighting sales regions in the British Isles.

Mr. E. J. Melville

Mr. J. M. Anderson

They are **Mr. E. J. Melville,** Southern Region, and **Mr. J. M. Anderson,** Scotland and Northern Ireland Region.

Mr. Melville joined the British Thomson-Houston Co., Ltd., in 1930 and was manager, northern area lamp and lighting sales, between 1935 and 1947. He was appointed sales manager of the southern area in 1947.

Mr. Anderson was assistant manager, lighting fittings and domestic appliances, at the G.E.C. Glasgow office between 1910 and 1915. After war service in the H.L.I. he joined the Metropolitan-Vickers Electrical Co., Ltd., Glasgow, as a sales engineer, becoming sub-area manager, East and North Scotland, in 1925 and Metro-Vick superintendent, Lamp and Lighting Department, Scotland, in 1930.

Mr. H. Shackleton, M.Sc., M.I.E.E., technical and research engineer with the North Western Electricity Board, has been appointed manager of the Board's No. 5 Sub-Area in succession to **Mr. R. H. Harral,** M.B.E., M.I.E.E., M.Inst.F., who, as we have already reported, retires at the end of May. Mr. Shackleton was educated at Burnley Grammar School and Manchester University. He joined Manchester Corporation Electricity Department in 1924 and served in various departments until August, 1944, when he became electro-technical engineer and personal assistant to the distribution engineer. Three years later he was appointed deputy engineer and manager to the Rochdale Corporation Electricity Department and served in this capacity until nationalisation when he became technical engineer in the No. 3 (Oldham) Sub-Area of the North Western Electricity Board. He was appointed technical and research engineer at Area Board headquarters in 1951 and since 1953 has also been responsible for system operation and maintenance.

Mr. H. Shackleton

Mr. Shackleton is the joint holder of a patent for a distribution failure indicator which is designed to show mechanically at a central control when trouble on a distribution system operates a fuse in a substation. He is a member of several national committees dealing with technical subjects.

The Minister of Fuel and Power has appointed **Colonel R. Mould-Graham,** O.B.E., M.C., T.D., D.L., as a part-time member of the North Eastern Electricity Board. **Sir Geoffrey Summers,** Bt., C.B.E., O.St.J., has been reappointed as a part-time member of the Merseyside and North Wales Electricity Board.

The British Central Electrical Co., Ltd., announces that **Mr. J. L. Potter** has been appointed manager of its Order and Buying Departments. Mr. Potter was previously in charge of the Progress Department and responsible for stock control.

The following appointments have been made by the Central Electricity Board, Mauritius:—**Mr. R. Desmarais,** A.C.G.I., B.Sc., A.M.I.E.E., distribution and transmission engineer; **Mr. R. du Mée,** A.C.A., accountant; and **Mr. N. Rey,** A.C.G.I., B.Sc., commercial engineer.

Mr. Vernon Young, who has been secretary of International Combustion (Holdings), Ltd., since the inception of the organisation is, for health reasons, relinquishing this position and **Mr. H. C. Short,** who is at present assistant secretary, has been appointed in his place. Mr. Young will remain a director of the company.

Mr. J. R. Short has been appointed sales lighting engineer with Holophane, Ltd., and he will represent the company's interests in Northern England. Mr. Short received his training at Sunderland Technical College and served an apprenticeship with F. Reid Ferens & Co., of Sunderland and Newcastle. In 1943 he volunteered for service in the Royal Navy and was later transferred, as technician, to the Royal Indian Navy. Since then he has held a number of positions, the last being with the North Eastern Electricity Board.

Mr. J. R. Short

Mr. W. J. Donnelly, who had been appointed technical representative, Midlands area, for the scientific and industrial division of Sunvic Controls, Ltd., has now been transferred to the Application Engineering Department at the works, Harlow, Essex.

Mr. G. C. Duckett, A.M.I.E.E., A.I.R.S.E., has been appointed general manager of Astral Switchgear, Ltd., Enfield. After engineering training with Mather & Platt, Ltd., and Newton Bros. (Derby), Ltd., Mr. Duckett was with J. Stone & Co. (Deptford), Ltd., on the development of carbon pile regulators and train lighting equipment. After war service as an electrical officer, R.N.V.R., being seconded to the Admiralty Technical Mission in Canada, Mr. Duckett, from 1946 on, was an assistant to the general manager of the Union Works, Wembley, of the General Electric Co., Ltd.

Mr. G. C. Duckett

Mr. D. Goulding has been appointed head of the Export Sales Department of Winston Electronics, Ltd. During the war he was in the Royal Signal Corps and was concerned with ultra

ELECTRICAL WHO'S WHO

The 1956–57 edition of the "Electrical Who's Who" is now available from Iliffe & Sons, Ltd., Dorset House, Stamford Street, S.E.1. This edition has been considerably enlarged and contains some 7,000 entries in addition to the index in which names in the biographical section are classified under companies or other organisations. The price remains at 21s (postage 1s 5d)

high-frequency beamed radio. Leaving the Army in 1947, he joined the British Overseas Airways Corporation and in the following year went to Electric & Musical Industries, Ltd., as personal assistant to the H.M.V. television sales manager. In 1951 he was appointed territorial sales manager for the Middle East and Africa for Park Davis & Co., Ltd.

Air Chief Marshal Sir John Nelson Boothman, K.C.B., K.B.E., D.F.C., is joining the board of Kelvin & Hughes, Ltd., on 1st May as technical sales director. Sir John was A.O.C.-in-C. Coastal Command before he retired after spending 35 years with the Royal Air Force. In 1931 he won the Schneider Trophy outright for Great Britain.

Mr. L. W. Barsdorf has retired after fifty-six years' service with the General Electric Co., Ltd. He joined the Peel Street Works of the G.E.C. at Salford as a draughtsman and soon took charge of the Switchgear Development Department and the testing of materials. Later, as general works superintendent for switchgear at Salford, he was responsible for erection and installation and, on transfer to the Witton Works of the G.E.C., he remained in charge of this work. In 1911 Mr. Barsdorf joined the newly created Switchgear and Instrument Department at head office under Mr. J. Y. Fletcher, since when he has played a leading part in switch and control gear development. He had many specialist technical interests, amongst which were the development for Trinity House of the first lighthouse equipment for large incandescent lamps, and the first airfield lighting control system in Britain. He took a leading part in many wartime projects including a time bomb de-energiser and many other A.R.P. devices.

The **Leicester Electrical Society** held its annual dinner-dance on 6th April at the Grand Hotel, Leicester. The president of the Nottingham Electrical Club, Mr. R. H. Ellis, proposed the toast of the Society and the president of the Society, Mr. G. E. Jackson, responded. Mr. K. Broom, vice-president, in proposing the toast of the guests coupled with the ladies, welcomed lecturers who had helped the Society during the winter session. He also welcomed Mr. W. G. Miles, chairman of the Leicester Branch of the E.C.A., Mr. D. H. Parry, Leicester Sub-Area manager, East Midlands Electricity Board, and Mr. Ellis. Mr. A. R. Hawes responded on behalf of the guests.

At the annual dinner-dance of the Leicester Electrical Society showing (left to right) Mr. R. H. Ellis (president, Nottingham Electrical Club) and Mrs. Ellis, Mr. G. E. Jackson (president, Leicester Electrical Society) and Mrs. Jackson, Mr. A. R. Hawes and Mrs. Hawes, Mrs. Broom and Mr. K. Broom (vice-president)

Officials of the North Eastern Electricity Board have made a presentation to **Mr. T. G. Huddlestone** of Hexham, who before his retirement, was district engineer at Hexham for the Board. Mr. Huddlestone received an electric razor and a plaque.

Ashley Accessories, Ltd., Ulverston, announce the appointment of **Mr. Douglas White,** A.C.A., as joint managing director. Mr. White returned from Canada in December, having relinquished his position as controller of the Canadian Chemical & Cellulose Co., Ltd., on accepting his new appointment.

Mr. D. White

The **Royal Engineers Association (London Group)** is holding a dinner-dance at the Chatham Room, Victoria Station, London, on Saturday, 28th April, at 6.30 for 7 p.m. Sappers of all ranks, serving and ex-service, are welcome. Tickets (12s 6d) may be obtained from Mr. J. S. Pearson, Room 31, Horse Guards, Whitehall, S.W.1.

At the ladies' evening of the North Western Branch of the Electrical Trades' Commercial Travellers' Association, showing (left to right): Mrs. W. Candelatt, Mr. Candelatt, Mrs. R. G. Brandon, Mr. Brandon, Mrs. R. H. Corlett and Mr. Corlett

The first ladies' evening of the North Western Branch of the **Electrical Trades' Commercial Travellers' Association** was held on 27th March at the Alma Lodge Hotel, Stockport. Mr. R. H. Corlett (chairman of the Branch) welcomed members and their friends, and Mr. R. G. Brandon (national president) praised the Branch for the progress it had made since its formation twelve months ago. Among others who attended were Mr. W. Candelatt (national chairman), Mr. J. H. Bowen and Mr. L. A. Fickling.

Mr. George H. Richardson, principal assistant (solicitor) in the Secretary's Department of the North Western Electricity Board, has been appointed deputy secretary of the Board. Mr. Richardson was educated at Crewe Central School and attended the Statutory Law School at Manchester University. He commenced his career with a Crewe legal firm and in 1946 was appointed assistant solicitor to the Clerk of the Cardiganshire County Council. In 1947 he became assistant solicitor to Oldham Corporation and joined the Board as principal assistant solicitor in 1950.

Wilkins & Mitchell, Ltd. ("Servis" electric washing machines), announce the appointments of **Mr. T. H. Roberts** as depot manager of the new Liverpool service depot at 79/81, Keble Road, Bootle, and **Mr. P. Johnson** as depot manager of the Edinburgh service depot at 17, Auchinlecks Brae, Newhaven.

The London Area golf meeting of the **Electrical Industries National Golf Championship** will be held on 12th July at the Stoke Poges Golf Club, Slough. Those who would like to take part are asked to get in touch with Mr. L. H. Welch, secretary, c/o the London Electricity Board, 60, St. Martin's Lane, London, W.C.2.

OBITUARY

Dr. E. C. Crittenden.—The death is reported from Washington of Dr. Eugene Casson Crittenden at the age of seventy-five. Dr. Crittenden was internationally known for his achievements in the development and adoption of electrical and photometric

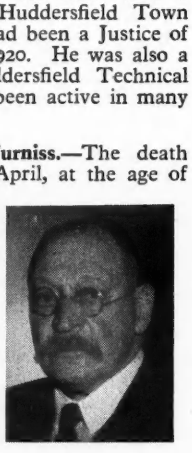
standards. He was vice-president of the International Commission on Illumination from 1939 to 1948 and president of the United States National Committee from 1928 to 1935. He represented the United States on the International Committee on Weights and Measures from 1946 to 1954 and was vice-chairman from 1950 to 1954. He took a leading part in replacing the obsolescent international system of electrical units by the so-called absolute units.

Mr. E. Brook.—We regret to report the death, on 16th April, of Mr. Ernest Brook, the founder of Brook Motors, Ltd. Mr. Brook was born at Pontefract, Yorks, in 1873 and he was educated at the Leeds School of Science and Art and the Yorkshire College. Up to about 1900 he was an electrical tester with Greenwood & Batley, Ltd., Leeds, but early in this century he decided to set up on his own. From small beginnings he built up the business of electric motor manufacture until to-day his company employs 2,700 people and has an annual turnover of about £4½ million. He retired from the chairmanship of the company in 1951 but remained on the board.

The late Mr. E. Brook

Mr. Brook was for some time a member of the Huddersfield Town Council and he had been a Justice of the Peace since 1920. He was also a governor of Huddersfield Technical College and had been active in many other directions.

Mr. W. M. Furniss.—The death occurred on 9th April, at the age of eighty-six, of Mr. William Marter Furniss, former chairman and managing director of the Electric Construction Co., Ltd., who retired in December, 1953, after more than fifty years with the company.



The late Mr. W. M. Furniss

Mr. Furniss had had sixty-three years' association with the electrical industry. In the 1890s he was engaged in the development of electricity supplies in Ireland, especially in Carlow, Bray (Co. Wicklow) and Larne. Later Mr. Furniss turned his attention to the South Wales coalfields in the very early days of the application of electricity to coalmining.

He joined the Electric Construction Co., Ltd., in 1902 as sales engineer. He was appointed general manager of the company in 1915, joining the board in 1926 and becoming managing director in 1942. He combined that office with the chairmanship of the company in 1948, retaining both appointments until his retirement in 1953.

His local activities, outside his company's interests, included the presidency of the Wolverhampton and District Engineering Society (1928-30), the presidency of the Wolverhampton Chamber of Commerce, and chairmanship of the Wolverhampton Corporation Electricity Committee (he was an Alderman of the borough) from 1928 to 1930.

Mr. Furniss leaves a widow, son and daughter.

Mr. A. E. Farrow.—The death occurred recently at the age of eighty-nine of Mr. A. E. Farrow, M.I.E.E., M.I.Mech.E., who, from 1896 to 1931, was chief engineer of the Windsor & Slough Electric Supply Companies. He was also a director of the Wishford Electric Co. and of the Woodstock Power Syndicate, Ltd.

Dr. J. Hettinger.—The death occurred on 13th April of Mr. John Hettinger, Ph.D., Dipl.Eng., M.I.E.E., F.C.I.P.A., who was a partner in the firm of Marks & Clerk, the patent agents.

WILLS

Mr. F. C. Burstall, deputy managing director of the Automatic Telephone and Electric Co., Ltd., who died on 7th December last, left £17,964 gross (£16,708 net).

Mr. F. Whipp, M.I.E.E., managing director, and one of the founders, of Whipp & Bourne, Ltd., who died on 14th January last, left £77,917 gross (£69,522 net).

Mr. A. W. Clegg, M.I.E.E., former borough electrical engineer of Accrington, who died on 11th February, left £3,011 gross (£2,852 net).

Mr. F. Ayton, M.I.E.E., former joint managing director of Ransomes, Sims & Jefferies, Ltd., who died on 24th January last, left £17,950 gross (£17,440 net).

Mr. E. S. Byng, vice-chairman of Standard Telephones and Cables, Ltd., who died on 13th January, left £11,174 gross (£11,048 net).

Mr. A. C. Campbell, A.M.I.E.E., of Croydon, Surrey, formerly electrical engineer at the Royal Mint, who died on 31st October, left £3,971 gross (£3,877 net value).

Mr. W. E. Bradshaw, A.M.I.E.E., of Hockley, Essex, formerly deputy engineer and general manager of the Islington Borough Council Electricity Department, who died on 19th November, left £9,081 gross (£8,958 net value).

Mr. C. V. Johnson, M.I.E.E., consumers' engineer, North West District, North Western Electricity Board, who died on 21st November last, left £3,240 gross (£3,181 net).

Mr. S. J. Matthews, head of the Research and Development Division of Baird and Tatlock (London), Ltd., who died on 2nd January, left £9,222 gross (£6,933 net).

Mr. T. E. Harris, C.B., C.B.E., M.I.Mech.E., M.I.E.E., Deputy Director-General, Royal Ordnance Factories, Ministry of Supply, who died on 18th July last, left £2,363 gross (£2,105 net).

Electrical Delegation to Russia

The delegation from the electricity supply industry who are visiting Russia under the leadership of Lord Citrine, chairman of the Central Electricity Authority, will spend about three weeks inspecting electric power stations and other electrical establishments in the U.S.S.R. They left from London Airport last Monday.

The members of the delegation are Messrs. J. Eccles, deputy chairman (operation), C.E.A.; J. S. Pickles, chairman, South of Scotland Electricity Board; C. T. Melling, chairman, Eastern Electricity Board; A. R. Cooper, controller, N.W., Merseyside and N. Wales Division, C.E.A.; R. L. Batley, controller, Midlands Division, C.E.A.; D. B. Irving, deputy chairman, London Electricity Board; D. P. Sayers, deputy chairman, Midlands Electricity Board; N. F. Marsh, deputy chairman, North Eastern Electricity Board; F. J. Lane, deputy chief engineer (transmission), C.E.A.; E. S. Booth, generation construction engineer, C.E.A.; F. Shakeshaft, mechanical engineering consultant, C.E.A.; J. C. Duckworth, nuclear power engineer, C.E.A.; J. Bird, chief engineer, S. Wales Electricity Board; W. H. Dunkley, chief generation engineer (construction), Yorkshire Division, C.E.A.; R. Y. Sanders, deputy chief commercial officer, C.E.A.; R. J. Rennie, distribution engineer, South of Scotland Electricity Board; J. F. Elphick (secretary), overseas liaison engineer, C.E.A.; and G. Froud (interpreter), assistant, Overseas Liaison Branch, C.E.A.

PRICES OF MATERIALS

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM Ingots	ton £189 0s 0d
COPPER, H.C. Electro	ton £377 15s 0d
Fire Refined 99·70%	ton £376 0s 0d
Fire Refined 99·50%	ton £375 0s 0d
COPPER Tubes ..	lb 3s 8¾d
Sheet	ton £451 15s 0d
H.C. wire and strip ..	ton £424 10s 0d
LEAD, English ..	ton £116 10s 6d
Foreign	ton £115 0s 0d
MERCURY	flask £86 0s 0d
TIN, block (English) ..	ton £767 10s 0d
ZINC, G.O.B. Foreign	ton £98 15s 6d
Electrolytic	ton —
BRASS TUBES (solid drawn)	lb 2s 11¼d
Sheet	ton £350 15s 0d
Wire	lb 3s 6¾d
PHOSPHOR BRONZE Wire	lb 5s 2½d
PLATINUM	oz £34 0s 0d
RUBBER, No. 1 R.S.S. spot	lb 27½d—27¾d

PARLIAMENTARY REPORT

Clean Air Bill

When the Clean Air Bill was considered on report in the House of Commons last week the Minister of Housing and Local Government, Mr. Duncan Sandys, introduced a new clause to provide for the setting up of a Clean Air Council, of which the Minister will be the chairman.

It will be the duty of the committee to keep under review the progress made in abating the pollution of the air in England and Wales, and to obtain the advice of persons having special knowledge, experience or responsibility in regard to prevention of pollution of the air. For like purposes the Secretary of State for Scotland is to appoint a Clean Air Council for Scotland.

Dr. Edith Summerskill said that Members representing industrial areas were anxious that they should be kept informed on what the Council was doing so that people should not lose interest in the subject; and Mr. Sandys gave an undertaking that a report on the work of the Clean Air Council would be made annually to Parliament. He said he believed in this policy and wanted the maximum publicity directed upon it. In answer to Mr. Nabarro, he said that the report he envisaged would cover the whole progress of reducing air pollution and would not be confined to the work of the Council. It would deal with the progress made by local authorities, research, and other matters.

The new clause was agreed to.

The House also agreed to a clause, moved by the Government, providing that the Minister could make regulations imposing requirements as to the installation of apparatus for indicating or recording the density of darkness of smoke emitted from furnaces. Explaining it, Mr. Enoch Powell, Parliamentary Secretary, said that in committee there was general agreement that there should be the most widespread and rapid use of methods of measuring and giving warning of the emission of smoke. The instruments required would differ according to the different types of furnaces, and it would be convenient that they should be prescribed from time to time in detail by regulation.

Dr. Stross said that in collating information there should be one specific standard of measuring apparatus. He understood that the British Standards Institution was now preparing such apparatus.

Mr. Nabarro moved a new clause requiring that any person operating furnaces designed to burn fuel at a rate of five tons a week or more should hold a certificate of proficiency. He said that similar legislation had been passed in other countries.

Mr. David Renton said that in the period 1953-55 1,499 men passed the City and Guilds' course for the boiler operator's certificate, and about 2,000 men were expected to take the course this year. There had been great co-operation on the part of industrialists and trade unions to get more men to undergo training and the Government was confident that, in view of the sanctions contained in the Bill, it was unnecessary to insert a further compulsion. The clause was negatived.

Mr. Richard Fort, who said he had long been associated with a company concerned with boiler control and other departments of technology, moved a new clause, the purpose of which was to ensure that those who were conducting research and developing methods of controlling the emission of dust and grit, and who might in the course of experiments cause the emission of smoke, grit and dust, were not prosecuted under the Bill.

Mr. Powell said that an amendment relating to research and experimental operations would be proposed when the Bill reached the Lords, and the clause was accordingly withdrawn.

Dr. Stross moved to delete from Clause 1 the defence that the emission of dark smoke was solely due to the use of unsuitable fuel, suitable fuel being unobtainable.

Mr. Sandys said it would be wrong and irresponsible for Parliament to make an offence of something which the experts had told him was unavoidable in certain circumstances. Within 10 years Parliament might consider the question further in the light of experience. The amendment was negatived.

Mr. Powell moved an amendment to Clause 5 making it necessary for furnaces burning solid fuel at a rate of one ton an hour or more to be provided with plant for arresting grit and dust. This substituted the figure of " one ton " for " 10 tons."

The amendment was agreed to.

Moving the third reading of the Bill, Mr. Powell said that changes in the techniques of using fuel and generating power had made it possible to impose much stricter requirements than would have been possible a decade or two ago. The guiding principle throughout had been enforceability; the House had agreed that nothing should be put into the Bill which could not and would not be enforced. The faults of the code of 1936, with its large prohibitions and large avenues of escape, had been avoided. The emission of dark smoke, not only from furnaces and chimneys, but also from railway engines and ships in port, now became an offence *per se*. For all new furnaces with substantial rates of fuel consumption or which burnt pulverised fuel, equipment to prevent grit and dust emission was an absolute requirement. The Bill's tendency would be to direct the work of science and technology into the solution of the problems which were still outstanding, such as sulphur pollution about which there was much concern. The provisions dealing with the establishment of smoke control areas should be in force before the end of the year, and all the others would be in in effect in about two years' time.

Winding up the debate, Mr. Sandys paid tribute to the part played in the campaign for clean air by Mr. Nabarro.

The Bill now goes to the House of Lords for consideration.

Visit to Russia

Mr. Palmer asked the Minister if he would arrange to make available to the House the report of the delegation of British electrical experts visiting Russia.

Mr. Jones replied that as this was a technical mission for which the Central Electricity Authority was entirely responsible, it will be for the Authority to decide in due course what information about the visit could usefully be published.

Trade with China

Replying to a question by Mr. Allaun, Mr. Nutting, Secretary of State, said that consultations about the embargo list were now proceeding and it was hoped that the China Committee of the Paris Consultative Group concerned with the United Nations embargo would be convened shortly to discuss the matter.

Underground Gasification of Coal

The Minister of Fuel and Power (Mr. Aubrey Jones) told Mr. Albu that the only cost estimates which could be made at this stage for the generation of electricity by the underground gasification of coal were based on small-scale experimental systems, of which the largest produced gas sufficient to generate 300 kW continuously for some months. While these estimates encouraged the hope that underground gasification could be exploited economically, they were based on a number of assumptions the validity of which it had not yet been possible to test.

Electrically Propelled Trawler

Mr. Hector Hughes asked the Parliamentary Secretary, Admiralty, if he knew that the Aberdeen-built research ship *Sir William Hardy* was the first British trawler to be electrically propelled and if this technique was being applied to other fishing trawlers.

Mr. Digby said he did. Although the use of this method was a matter for

the trawler owners themselves, the technical assistance of the Admiralty was always available to the shipbuilding and marine engineering industry, should they require it. There were other orders in hand in British yards for diesel-electric trawlers.

Assisted Wiring

Replying to Mr. Michael Stewart, the Minister of Fuel and Power said he had received representations that the London Electricity Board should introduce an assisted wiring scheme to help tenants whose houses had faulty electrical wiring, but the Board, with the full agreement of the London Electricity Consultative Council, had decided that it would not be justified in doing so in present circumstances. Section 60 of the 1947 Act gave him no powers to make any Board introduce an assisted wiring scheme.

Mr. Stewart referred to the Minister's powers under Section 60 of the 1947 Act to make regulations fit for the purposes of safety, and said that since the object of the assisted wiring scheme was to promote safety, should he not make regulations dealing with such a scheme ?

Mr. Jones said it was largely a matter of legal interpretation, but he could assure the House that Section 60 gave him no powers to make regulations about wiring, and that was the point of the question.

Asked by Mr. Callaghan whether he considered that public enterprises ought to be run with regard to social obligations as well as commercial profit, Mr. Jones said that nationalised undertakings should have an eye to commercial considerations but, being public undertakings, they ought to display slightly greater latitude than private undertakings in having regard to social considerations. It was the conclusion of the London Board, rightly or wrongly, that it should not introduce any scheme of this nature and it was not for him to interfere with the Board's judgment.

Nuclear Power

Mr. Snow asked the Minister of Agriculture if he would give the reasons for his Department's objection to the proposal to establish a nuclear power station in the estuary area of the rivers Crouch and Roach.

Mr. Amory replied that the Minister of Fuel and Power had received no proposal for a nuclear power station in that area.

Mr. Snow said it was believed that an official of the Ministry of Agriculture made strong representations that there should be no power station in that area because of the existence there of oyster beds.

Mr. Amory said he had no doubt that if and when a proposal was made to the Minister of Fuel and Power he would consult the Ministry of Agriculture.

Mr. Warbey asked the Lord Privy Seal what limitations were at present imposed on the number, type, and capacity of nuclear reactors which might be constructed, owned, and operated in the United Kingdom by private industry.

Mr. R. A. Butler said there were no statutory limitations, but any control necessary in this field could at present be secured through the Atomic Energy Authority's monopoly of fissile material.

Mr. Warbey asked whether the Minister had seen Press reports that the Authority are now apparently prepared to encourage private industry to construct their own nuclear reactors without limit.

Mr. Butler replied that they had in reserve the necessary powers.

Sir David Robertson asked the Lord Privy Seal if he was aware that a 68-hour week was being worked at Dounreay, and that other essential building work on housing, schools, slum clearance, and agriculture could not be manned unless similar excessive overtime earnings were paid.

Mr. Butler said the Atomic Energy Authority had told him that the single shift system at present operating at Dounreay was necessary to complete the work in time for the station to fulfil its function in the nuclear power programme. Recruitment of two eight-hour shifts, if this were possible, would mean an increase of at least 40 per cent in the labour force, amounting to 800 more men at the peak period. In the Authority's opinion this would cause more local disturbance than the present arrangements.

In reply to a further question Mr. Butler said it was because the Government did not want the project delayed that these rather exceptional hours were being worked.

Radio Sets for Colonies

Mr. Brockway asked the Colonial Secretary what assistance had been given in the provision of radio sets to populations in the Colonial territories and if such assistance could be extended in view of the difficulties which the electronic industry was experiencing in this country.

Mr. Hare, Minister of State, said the Colonial Office had frequently drawn attention to the need for cheap battery-operated sets designed for use in tropical conditions. Many Colonial Governments encouraged the import of such sets by remission of duty. In certain instances there were preferential rates. In addition some 5,000 community receivers had been purchased for use in the colonial territories though, in general, listening to individual sets was preferred. There was now a growing demand for more expensive sets. He felt sure that with intensified efforts British manufacturers would find good opportunities in this expanding market.

Lake District Scheme

Mr. Vane asked the Minister when he intended to give his decision about the proposed supply extension by the North Western Electricity Board near Ullswater, known as the Deepdale spur.

Mr. David Renton, Parliamentary Secretary, said the National Parks Commission had made representations about part of the Board's proposals and discussions had been proceeding in the hope that agreement might be reached. This had not proved possible and the Minister was re-examining the problem.

Mr. Vane said that after long consideration the Lake District Planning Board and the North Western Electricity Board came to an agreement about the route of the spur but since the middle of January the National Parks Commission had been displaying discreditable delaying tactics.

Mr. Renton said the Lake Planning Board approved the lines being erected but he could not accept what Mr. Vane said about the Parks Commission, who could not agree to the lines being overhead.

THE BUDGET

ON Tuesday last Mr. Macmillan, Chancellor of the Exchequer, introduced his first Budget. He reviewed the country's financial and economic position and said that credit restrictions must be continued. Dealing with the capital expenditure of nationalised industries, he said that their available profits were insufficient and 60 per cent of their investments came from external sources. He proposed as a temporary measure to meet the capital requirements of these industries out of the Exchequer and they would in future look to the banks only for their normal requirements of short-term capital. The new system would be for two years only, and the maximum sum would be £700 million; the issue of about £350 million would be required in 1956-57.

The Chancellor's proposals included the suspension of initial allowances (except for fuel-saving equipment); the raising of tax on undistributed profits to 3 per cent and on distributed profits to 30 per cent; the giving of tax relief to self-employed persons in respect of deferred retirement annuities; the issue of a new series of savings certificates; and the introduction of premium bonds.

Guide to Automation

A simple explanation of automation is given in a booklet entitled "Flow Production and Automation," by F. G. Woollard, published by the Industrial Administration Group, College of Technology, Gosta Green, Birmingham, 4, at 5s.

Digital Computer Techniques

PROCEEDINGS OF LAST WEEK'S I.E.E. CONVENTION

To encourage the greater application of technical effort which is needed to take full advantage of the great potentialities of digital computer techniques the Committees of the Measurements and Control and Radio and Telecommunication Sections of the Institution of Electrical Engineers organised a convention on the subject which took place at the Institution from 9th to 13th April. Altogether some fifty-eight papers were presented and these covered not only the detailed design of digital computers but also their application in various fields of activity and included plenty of interesting material for both specialists and non-experts. In this way very complete coverage was given to this important new field of activity. The technical sessions were in two groups, running at the same time, one group dealing with specialist and the other with general topics.

At the opening session on Digital-Computer Techniques, held on Monday, 9th April, Sir George Nelson, President of the I.E.E., who was in the chair, emphasised that there was no need for potential users to wait for further developments. Such developments would be relatively small, and immediate steps should be taken to use the machines which were now available and would be found to be reliable.

Sir Cyril Hinshelwood, President of the Royal Society, who gave the opening address, said that there was scarcely a branch of science in which the application of rapid and efficient calculation did not offer the prospect of solving hitherto intractable problems, and the displacement of man-power would effect enormous savings, but the necessity to produce persons capable of playing their part in the design, manufacture, control, maintenance and programming of such machines was an alarming prospect. The wide introduction of these machines would solve and create many social problems, and ultimately give rise to profound changes in the organisation of society. In all this development men of science must play the part of leaders and not of hired experts of scientifically illiterate administrators.

Speed and Reliability

In his introductory lecture Prof. F. C. Williams said there were several reasons for the attractiveness of computing machines, which had led to their rapid development. Three were inherent properties of the machine—its speed, the fact that it was automatic, and the fact that it was universal, in the sense that it could solve any problem which could be solved by a process of numerical analysis. There were also certain facts which had emerged in the light of experience—freedom from error, reliability and the ability, due to speed of operation, to do a job in the cheapest possible way.

With regard to future developments, the introduction of the transistor would reduce the size and power consumption of computers to a remarkable degree. Improvements were desirable in storage. There was also likely to be a retreat from universality and the production of machines which, though universal in principle, would have a balance between their various parts which fitted them for a particular application. The major division would be between the scientific computer and the commercial computer. The real advance in the next decade, however, would almost certainly be on the side of application. The machines could take over all routine computation from human brains, and this might be, as Sir Cyril Hinshelwood had said, a second industrial revolution, with mental rather than physical labour being taken over by machines.

Computer Applications

The first of the general sessions, on Tuesday morning, dealt with the engineering and scientific applications of digital computers and showed how these machines can be used to assist in the solution of a variety of problems. In the first paper Dr. J. M. Bennett[1] explains that in distribution networks, the power generated or consumed at the various busbars is usually known, together with the voltage of one busbar and a specification of how the system losses are supplied; the information most useful to the power engineer is a list of the corresponding current flows and voltages throughout the network.

Dr. Bennett sets out a technique for carrying out this work with an automatic digital computer, with special reference to programming devices which have been found useful. The work was done on the Manchester University computer, and information about speeds of computation of a typical example are given. The example chosen is a "closed loop" system—i.e. the product of the vector transformation ratios around any loop taken in a common direction is unity.

The proton synchrotron being built at Geneva for the European Council for Nuclear Research employs a new magnetic focusing principle, and minor irregularities in the magnets will cause perturbations in the free oscillations of the protons. In order to find out the condition under which the amplitude of these oscillations will not increase indefinitely, calculations have been made using the Pilot Ace at the National Physical Laboratory. Mr. G. G. Alway[2] dealt with the mathematical aspects of two kinds of calculations in which methods for evaluating integrals of the type

$$\int_0^{\gamma} (1 - k^2\sin^2 t)^{-1/2}dt, \quad \int_0^{\gamma} (1 - k^2\sinh^2 t)^{-1/2}dt$$

are developed. These methods also show how to evaluate the upper limit γ when the integrals are known.

In the next paper Mr. W. D. Worthy[3] explains that the behaviour of a linear servo-mechanism may be described by a set of linear first-order simultaneous differential equations. The computer programme applies, however, to other problems that can be described similarly and to partial differential equations which can be reduced to this form by finite-difference approximations. The digital differential analyser and similar analogue devices are considered, but a general-purpose machine is more versatile. A form of Runge-Kutta formula for the numerical integration of the equations is described.

Each coefficient in the set of equations may be described by a code word which specifies both its magnitude and location. An interpretation routine examines these code words in turn and evaluates the derivatives required in the integration formula. The solution for any variable may be punched out or displayed on a cathode-ray tube, and parameters are easily varied when searching for an optimum design. By adding suitable sub-routines the general programme is easily adapted to handle non-linear systems.

The technique is most useful for supplementing preliminary studies on a simple analogue computer and is

more adaptable for non-linear systems. A simple worked example is used to illustrate the principles without assuming previous experience of either numerical analysis or computing machines.

The calculation of train running times, given the power/speed characteristics of the locomotive, the resistance to motion of the train and the topography of the route, is carried out by most traction equipment manufacturers and by many railway administrations. The results of these traction performance calculations are used to determine the most suitable design of equipment for carrying out a certain task, and the effect on fuel consumption of variations in time schedules and loadings. These calculations are extremely laborious if carried out by hand, but Mr. A. Gilmour[4] shows that with the arrival of the digital computer it is now possible to carry them out with extreme rapidity. The speeds of computation vary between 200 route-miles per hour for a d.c. electric suburban train with frequent stops to 2,000 route-miles per hour for a diesel-electric main-line train.

The analysis of electric circuits by matrix methods is well established as a means of obtaining differential equations relating the electrical quantities in a circuit with the impedance properties of the circuit. The equations for circuits containing linear elements can be expressed as simultaneous, linear first-order differential equations with constant coefficients. Messrs. S. J. M. Denison and D. G. Taylor[5] describe a " Deuce " programme for solving such equations by a step-by-step method, and show that many switching problems are amenable to solution using this programme. For a problem involving a single switching operation the procedure is to establish the equations for the circuit configuration after the switching operation and to solve these equations from known initial conditions for a suitable duration. A problem involving a number of sequential switching operations can be dealt with as a series of single switching problems, the final conditions for one problem proving the initial conditions for the subsequent problem.

In the design and operation of power systems, as in other fields of engineering, the use of digital computers can be most easily justified on those problems for whose solution existing methods are inadequate or are uneconomically time-consuming. Further applications become evident if existing techniques can be shown to be less accurate, less economic or less direct in formulation than those possible with the use of a high-speed digital machine. The topics discussed by Messrs. C. Robinson and D. H. Tompsett[6] reduce to matrix manipulation, the solution of linear equations and the determination of latent roots and vectors of a matrix. These linear algebra problems are particularly suited to solution on digital computers: indeed, they are of such frequent occurrence in many fields that interpretive routines exist so that programmes for a long sequence of matrix manipulations can be assembled in a few minutes.

The session was concluded by Mr. B. Birtwistle and Miss B. M. Dent[7] whose paper discusses the value of the digital computer in the light of the authors' extensive use of the Manchester University machine during the past three years. Mr. J. V. Oldfield[8] also made a contribution on transformer design with digital computers.

One of the main business applications of the computer is shown, in the paper by Mr. D. W. Davies,[9] to be the sorting of data. Although many methods of sorting can be used, different sorting problems require different processes, not only for efficiency of sorting, but also to preserve such order as already exists in the data. The sorting methods known to the author are described in the paper, and their effectiveness is evaluated in various types of sorting problem. The sorting methods described employ a digital computer with magnetic tape external storage, and attention is given to the organisation of transfers between the computer and the tapes, and the management of tape-reel changes.

Construction and Performance

The last three general sessions of the convention dealt with the construction and performance of digital computers. In his paper, Mr. A. C. D. Haley[13] describes the " Deuce " which is a high-speed general-purpose binary digital computer, operating throughout in the serial mode at a digit frequency of 1 Mc/s, and using mercury delay lines as its primary storage system. It is a development from the Pilot Model " Ace," which was developed by the National Physical Laboratory and has had an outstandingly successful career since it was commissioned in 1952. Many features of " Deuce " are common to this earlier machine, but a number of operational improvements have been made, together with additional features to facilitate maintenance and also to reduce the problems of testing new programmes. Input to and output from the computer are by means of high-speed punched-card machines, and a large-capacity (8,192 words) magnetic-drum store augments the main mercury-delay-line storage system.

In the paper by Messrs. K. Lonsdale and E. T. Warburton[14] details are given of the design and construction of a new universal high-speed serial digital computer with a digit repetition frequency of 1 Mc/s. Logical differences between the production machine, called " Mercury " and its prototype, which was built at Manchester University, are discussed in some detail. The HEC4E computing machine described by Mr. R. Bird[18] was designed specifically for application to commercial calculations. It is an electronic digital machine of medium size functioning in the serial binary mode, the pulse repetition frequency being 40 kc/s and the word length 40 binary digits. The main storage for both numbers and instructions is a magnetic drum having 64 tracks each holding 16 words.

Besides being able to perform all four arithmetical functions automatically, the machine has facilities for the automatic conversion to and from the binary scale for any normally used scale of notation.

The input is by means of standard punched cards, and both a printing mechanism and a card punch are provided for the output of results. The machine is constructed in four physical units: the electronic unit, containing about 1,100 thermionic valves; the operating console, providing manual controls and a visual display of the course of calculation; the tabulator providing both punched card input facilities and the printed output; and the card-punching output mechanism.

The " Programme-Controlled Computer " (P.C.C.) which has been designed for commercial work, is described by Messrs. E. J. Guttridge and R. P. B. Yandell.[19] The programme instructions are not entered into the computing store, but are set up on switches preparatory to a computation taking place. The control is such that immediate access is available to each instruction, and that transfer of control and modification of address are possible. Storage of immediate access and of slow access is provided on a magnetic drum. Numbers are represented throughout the computer in sterling or decimal form. Input and output are by means of punched cards, flexibility being provided by plugboards.

A very good example of the way in which electronic techniques are being harnessed to mechanise accountancy is given in the paper presented by Mr. L. Knight.[20] The calculator described is a commercial product, designed for use with standard punched-card machines. It will read

numbers off a card, calculate new information from these and punch the answers back into the same card, handling 100 cards/min. It can add, subtract, multiply and divide, both in decimal and £ s d notation, and can be easily preset to perform any sequence of these operations. This sequence can be modified by special instructions on the card or as the result of a step in the calculation. Facilities exist for an automatic and thorough check that the correct answers have been punched into the card.

In the last of the general sessions dealing with construction and performance, six papers were presented which describe experimental computers. For example, the paper by Drs. T. Kilburn, D. B. G. Edwards and G. E. Thomas,[21] describes the " Mark II " digital-computing machine now operating in the Computing Machine Laboratory of Manchester University. It has a 100 kc/s parallel cathode-ray tube store and a 1 Mc/s serial control, B-register and accumulator. Thus, internally, the speed of the machine is inherently greater than that of its predecessor by a factor of ten. Orders which concern the B-register or control are extracted from the store and obeyed in 60 microsec.

The machine has a floating-point accumulator, numbers being represented in the form $x2^y$, where x and y are respectively 30 and 10 digits in length. Numbers to be added to the accumulator are automatically shifted appropriately before addition; they are then added and the sum is standardised. An order involving such a floating-point addition is extracted from the store and obeyed in 180 microsec. Similar remarks apply to subtraction. For multiplication, which involves floating-point addition to, or subtraction from, the accumulator, the corresponding time is 360 microsec.

Another interesting contribution in the same session was made by Mr. J. A. Tempel.[22] His paper describes an electronic digital calculator designed to perform accounting and other calculations. The calculator is capable of performing the four main arithmetical functions of addition, subtraction, multiplication and division. It receives the information from a punched card, performs the required calculations and punches out the answer on the same card. The main features of the calculator are ease of programming, low power consumption, low cost of production and facilities for servicing.

Transistor Computers

Two sessions of the convention were concerned with the use of transistors in digital computers. In one paper, which was presented by Messrs. E. H. Cooke-Yarborough, R. C. M. Barnes, Dr. J. Stephen and Mr. G. A. Howells,[27] a small digital computer is described which has a magnetic-drum store and uses some 330 transistors as the only active circuit elements. The logical design is unusual, involving the interleaving of the digits of numbers stored on the drum; this permits three-address operation, all three addresses being on the drum, and calls for relatively little storage capacity external to the drum. Although the time taken to perform individual operations is rather long, this is compensated for by the fact that the design readily permits a close approach to an optimum programme.

The magnetic-drum store for a small transistor digital computer operating at 58 kc/s is described in another paper by Dr. J. H. Stephen and Mr. E. H. Cooke-Yarborough.[29] The logical design of the computer requires the interleaving of the digits of the words—an arrangement which makes many words on the drum available concurrently and therefore permits economical three-address operation. The working store has a capacity of 426 words, including a regenerative loop which is necessary for temporary storage, since not all the words are available concurrently. The proposed main store, which will be relay selected, has a capacity of 16,384 words. Circuits are described for writing and reading the interleaved words on to and from the drum and for producing the timing pulses for the whole computer.

A paper by Dr. T. Kilburn, Dr. R. L. Grimsdale and Mr. D. C. Webb[30] describes the design of a transistor digital computer, the full-scale machine and its prototype. The general arrangement of the two machines is similar, and both employ a magnetic drum for the main and auxiliary stores. The latter are provided by regenerative tracks or revolvers which have reading and writing heads spaced by a distance equivalent to one, two or eight word periods. The output of the reading amplifier is connected via a gate to the writing amplifier, and the track operates as a delay-line type of store.

Point-contact transistors are used principally as pulse amplifiers, staticisors and for waveform generation. In the pulse amplifier the transistor operates as a two-stage circuit; it is turned on by a digit pulse and reset at the end of each digit period by a regular clock waveform with a pulse repetition frequency of 125 kc/s. Point-contact diodes are used to perform the logical operations and for gating. Two-stage circuits employing single transistors are also used for the staticisors and for the waveform generation units.

Digital computing techniques would probably find wider application than they do to-day in such fields as data handling and industrial control were it not that they tend to lead to bulky equipment of heavy power consumption and relatively poor reliability. The paper read by Mr. G. H. Perry, Dr. G. R. Hoffman and Mr. E. W. Shallow[31] describes a basic circuit using a combination of a ferrite ring core of square-loop hysteresis characteristics and a junction transistor, which makes possible the design of digital equipment of extreme economy, compactness and reliability. Applications to the design of shift registers, pulse separators and counters are outlined.

The final paper on transistors was presented by Dr. G. R. Hoffman and Mr. M. A. Maclean.[32] This describes a number of binary counting circuits using junction transistors and " square loop " magnetic cores as the basic circuit element. Ferrite cores made for matrix storage systems are used, since they have two well-defined remanent magnetic states which provide the necessary information storage when the circuit is quiescent. Junction transistors are used as pulse-shaping amplifiers which provide output signals and switch the cores from one remanent state to the other.

The apparatus described by Mr. F. Beckett[33] accepts pulse signals representing 11-digit binary numbers and from these generates voltages proportional to the magnitude of the numbers. The output voltage is available for display for at least 400 microsec within 700 microsec of the number being fed in. Resetting occupies a further 300 microsec, and the apparatus works continuously on a 1·4 millisec cycle. The conversion takes place in two stages. In the first a time analogue of the number is generated by a crystal-controlled binary counter, and in the second a linear time-base produces a voltage proportional to this time interval. The adjustment of the apparatus is simple, and experience indicates that a weekly check is sufficient to maintain 11-digit accuracy.

Relay counting circuits to meet conventional requirements were considered by Mr. G. C. Tootill[34] who shows that if only one relay is allowed to move at the start and at the finish of each input pulse, the minimum total number of relays is required. The sequence of states of the circuit can thus be characterised by a cyclic permuted code. Circuits using the reflected binary cyclic permuted code are given, with means of adapting them so that the number

of states in the counting cycle is not restricted to be a power of two. These have the disadvantage of different relays wearing at different rates. Basically, different cyclic permuted codes are given, for the particular cases of four digits and five digits, resulting in more even wear. No code with this property has been found which applies to any number of digits.

In some applications, e.g. on an accurate radar equipment, it is desirable to convert the angular setting of a shaft to digital form with high accuracy, and one method of achieving this end is described in a paper by Messrs. W. S. Elliott, R. C. Robbins and D. S. Evans.[35] A master binary disc is made photographically on a dividing engine. A photographic copy of the disc is coupled directly to the shaft whose setting is to be measured and is scanned to produce a digital signal representing the shaft angle or a function thereof. A number of convertors were made with scales sub-divided to give an accuracy of the order of 1′ of arc. They were used under conditions of severe vibration and exposure, and amply demonstrated the principle of the high-accuracy binary disc. A follow-up servomechanism was made and demonstrated, in which one shaft followed another by a digital link, to an accuracy of 1′ of arc. The limitation of accuracy is in the production of the binary discs.

The remainder of the sessions were of a specialist nature and the papers presented were primarily intended for designers and operators of digital computers. For example, the paper by Mr. R. A. Brooker and Mr. F. H. Sumner[39] draws attention to a method suggested by Lanczos for arriving at the reduced characteristic function of a matrix, and shows how it may be used with an electronic computer to evaluate automatically the characteristic roots and vectors of a real symmetric matrix, no matter how degenerate. In another paper Mr. R. A. Brooker[40] gives an account of the programming strategy developed for use with the University of Manchester electronic computer "Mark I," a typical 2-level storage machine of which a brief description is included. A method, suitable for use on an automatic computer, is developed for the solution of the heat-conduction equation in the paper by Mr. E. L. Albasiny.[41] The treatment of latent heat is discussed and the method applied to a simple case. An " Ace " programme is briefly described, and the results obtained for a typical experimental case are given in graphical form.

In a paper on the classification and design of operation codes for automatic computers Dr. K. D. Tocher[42] has attempted to design a code for an automatic computer which will meet both the demands of the engineers for simplicity of control and those of programmers for flexibility with the facilities provided. In similar vein Messrs. E. A. Newman and M. A. Wright[43] describe a new technique of identifying numbers, in which each number is associated with an identifying group of digits, and a tag, which is stored with it. A number is selected by reference to this group of digits, and not by reference to its storage location. This technique is of general application, but it is described in the context of a new machine. One session was concerned entirely with rapid access storage including the use of magnetic cores for storage and switching. A paper by Dr. A. A. Robinson, Dr. V. L. Newhouse and Messrs. M. J. Friedman, D. G. Bindon and I. P. V. Carter[44] describes a store for use with a computer requiring parallel access to 10-digit numbers at 10 microsec intervals. It is designed for a capacity of 1,024 such numbers. Messrs. G. G. Scarrott, W. J. Harwood and K. C. Johnson[45] describe a technique for designing " building bricks," using magnetic cores operating at a digit frequency of about 100 kc/s to obtain both input discrimination and power gain. Examples are given of the way in which these units can be assembled to provide various commonly required computer functions, and the likely limitations on their use are outlined.

An explanation is given in a paper by Mr. G. C. Tootill[46] first of the use of a quantising circuit with positive feedback to exhibit a multiplicity of stable states, and then of an alternative quantiser based on digital representation. Another principle for storage is described, providing storage in an unnatural binary-digital system of numeration. A way of removing this defect is next given, to provide a cheap binary storage circuit. Finally, a generalisation of these principles is proposed, to permit economical storage of several digits of radix other than two. The concluding paper of the session, by Dr. D. B. G. Edwards[47] describes the design and construction of a parallel-type cathode-ray-tube storage system built to operate with the Manchester University " Mark II " machine. The term " read around ratio " is defined and a new method for its measurement is described. An address-control system and a method of displaying the contents of the main store are also discussed.

Another session was devoted to the uses of magnetic tape in digital computers. One paper, by Dr. T. Kilburn, Dr. G. R. Hoffman and Mr. P. Wolstenholme[48] describes a method of reading information recorded on a magnetic medium, in which the velocity of the medium can have a wide range of values including zero. Read signals are obtained by varying the reluctance of the reading head. With a head constructed according to this principle 50 binary digits per inch have been read from magnetic tape. A description is given by Dr. M. V. Wilkes and Mr. D. W. Willis[49] of an auxiliary storage system using magnetic tape which has been operated experimentally on the " Edsac." The tape transport system uses pneumatically operated capstans and is capable of traversing tape in either direction at a speed of 100 in/sec; the starting and stopping times are about 10 millisec. The tape reels are controlled by photo-electrically operated servo systems. The motion of the tape, and the action of reading and writing, are controlled by instructions added for the purpose to the " Edsac " instruction code, and a detailed discussion is given in the paper of the way in which sub-routines for transferring blocks of information to and from the tape may be written. The final paper of the session was presented by Dr. A. A. Robinson and Messrs. F. McAulay, A. H. Banks and D. Hogg.[50] This deals with a magnetic tape digital recording equipment which arose from work done on the design of a magnetic tape backing store.

The final session of the convention was concerned entirely with circuit techniques and components of various types of digital computer. Altogether eight papers were presented, each of which was of a highly specialised nature.

REFERENCES TO PAPERS

ENGINEERING AND SCIENTIFIC APPLICATIONS

1. " Digital Computers and the Load-Flow Problem." J. M. Bennett.
2. " The Use of the Pilot ' ACE ' for Testing a New Design of Proton Synchrotron." G. G. Alway.
3. " The Use of Interpretation Routines on a General-Purpose Digital Computer for the Design of Linear and Non-Linear Control Systems." W. D. Worthy.
4. " The Application of Digital Computers to Electric Traction Problems." A. Gilmour.
5. " The Use of Digital Computers in obtaining Solutions to Electric Circuit Problems including Switching Operations." S. J. M. Denison and D. G. Taylor.
6. " The Use of Digital Computers on Power System Engineering Problems." C. Robinson and D. H. Tompsett.
7. " The Digital Computer as an Aid to the Electrical Design Engineer." B. Birtwistle and Miss B. M. Dent.
8. Contribution on Transformer Design with Digital Computers. J. V. Oldfield.

BUSINESS APPLICATIONS

9. "Sorting of Data on an Electronic Computer." D. W. Davies.
10. Contribution on the Use of a Computer for Payroll Work. E. A. Newman and M. A. Wright.
11. Contribution on Gamma 3 and Magnetic Drum Extension. P. Dreyfus.

INDUSTRIAL CONTROL APPLICATIONS

12. "The Application of Digital Computers in the Exploration of Functional Relationships." G. E. P. Box and G. A. Coutie.

CONSTRUCTION AND PERFORMANCE

13. "The 'DEUCE': A High-speed General-Purpose Computer." A. C. D. Haley.
14. "The Design and Construction of 'MERCURY' a High-Speed Digital Computer, based on Manchester University Mark II." K. Lonsdale and E. T. Warburton.
15. Contribution on 650 and 700 Series Computers. M. P. Barnett.
16. Contribution on the 400–405 Series Computers. A. St. Johnston.
17. Contribution on the "PEGASUS" Computer. W. S. Elliott.
18. "The 'HEC4.E' Computer." R. Bird.
19. "The Programme-Controlled Computer; a Digital Computer for Commercial Applications." E. J. Guttridge and R. P. B. Yandell.
20. "An Electronic Calculator for Punched-Card Accountancy." L. Knight.
21. "The Manchester University Mark II Digital Computing Machine." T. Kilburn, D. B. G. Edwards and G. E. Thomas.
22. "The Acoustic Delay-Line Electronic Calculator." J. Tempel.
23. Contribution on "EDSAC II." W. Renwick.
24. Contribution on Operating Experience on "NICHOLAS." S. E. Hersom.
25. Contribution on "ACE." E. A. Newman and D. O. Clayden.
26. Contribution on "IMP": an Auxiliary Digital Computer for Complex Numbers. M. W. Humphrey Davies and Y. El Hakim.

TRANSISTOR COMPUTERS

27. "A Transistor Digital Computer." E. H. Cooke-Yarborough, R. C. M. Barnes, J. Stephen and G. A. Howells.
28. "Transistor Arithmetic Circuits for an Interleaved-Digit Computer." R. C. M. Barnes, G. A. Howells and E. H. Cooke-Yarborough.
29. "An Interleaved Digit Magnetic Drum Store for a Transistor Digital Computer." J. Stephen and E. H. Cooke-Yarborough.
30. "A Transistor Digital Computer with a Magnetic Drum Store." T. Kilburn, R. L. Grimsdale and D. C. Webb.
31. "A New and Simple Type of Digital Circuit Technique using Junction Transistors and Magnetic Cores." G. H. Perry, G. R. Hoffman and E. W. Shallow.
32. "Quiescent-Core Transistor Counters." G. R. Hoffman and M. A. Maclean.

INPUT AND OUTPUT

33. "A Rapid Digital-to-Analogue Converter for Numbers having Eleven Binary Digits." F. Beckett.
34. "The Use of Cyclic Permuted Codes in Relay-Counting Circuits." G. C. Tootill.
35. "Remote Position Control and Indication by Digital Means." W. S. Elliott, R. C. Robbins and D. S. Evans.

THE NON-ARITHMETIC ROLE

36. Contribution on Computer Operations needed for Mechanical Translation. A. F. Parker-Rhodes.
37. Contribution on Making a Computer Play Draughts. Dr. A. L. Samuel.
38. Contribution on Character Recognition. Mr. Kloalmat.

NUMERICAL ANALYSIS

39. "The Method of Lanczos for Calculating the Latent Roots and Vectors of a Real Symmetric Matrix." R. A. Brooker and F. H. Sumner.
40. "The Programming Strategy used with the Manchester University Mark I Computer." R. A. Brooker.
41. "The Solution of Non-Linear Heat Conduction Problems on the Pilot 'ACE'." E. L. Albasiny.

LOGICAL DESIGN

42. "The Classification and Design of Operational Codes for Automatic Computers." K. D. Tocher.
43. "An Automatic Floating Address Machine." E. A. Newman and M. A. Wright.

RAPID ACCESS STORAGE

44. "A Digital Store using a Magnetic-Core Matrix." A. A. Robinson, V. L. Newhouse, M. J. Friedman, D. G. Bindon and I. P. V. Carter.
45. "The Design and Use of Logical Devices using Saturable Magnetic Cores." G. G. Scarrott, W. J. Harwood and K. C. Johnson.
46. "Some Storage Circuits based on Valves." G. C. Tootill.
47. "The Design and Operation of a Parallel-Type Cathode-Ray-Tube Storage System." D. B. G. Edwards.

MAGNETIC TAPE SYSTEMS

48. "Reading of Magnetic Records by Reluctance Variation." T. Kilburn, G. R. Hoffman, and P. Wolstenholme.
49. "A Magnetic-Tape Auxiliary Storage System for the EDSAC." M. V. Wilkes and D. W. Willis.
50. "Some Factors affecting the Construction of a Magnetic-Tape Digital Recording Equipment." A. A. Robinson, F. McAulay, A. H. Banks and D. Hogg.

CIRCUIT TECHNIQUES

51. "Electromagnetic Delay Networks for Digital Storage." G. G. Scarrott, W. J. Harwood and K. C. Johnson.
52. "Wire-type Acoustic Delay Lines for Digital Storage." G. G. Scarrott and R. Naylor.
53. "A Sonic Delay Line Storage Unit for a Digital Computer." J. W. Fairclough.
54. "The Use of Electromagnetic Delay Lines in the Manchester University Mark II Digital Computing Machine." G. E. Thomas.
55. "The Magnetic Storage Drum on the 'ACE' Pilot Model." D. O. Clayden, L. J. Page and C. F. Osborne.
56. "A Multi-Input Analogue Adder designed for Use in a Fast Binary Multiplier." D. B. G. Edwards.
57. "A Fast Parallel Arithmetic Unit." K. D. Tocher and M. Lehman.
58. "The Transfer Track Method of Magnetic-Drum Operation." J. E. Flood and R. S. Hopkins, and H. A. Showell.

Overseas Installation Contracts

"PROBLEMS in Connection with Carrying Out Overseas Installation Contracts" was the title of a paper presented by Mr. J. Flood, Associate I.E.E. (Troughton & Young, Ltd.), at a meeting last Tuesday of the Association of Supervising Electrical Engineers.

Mr. Flood said that conditions set out in overseas contracts should be carefully studied; sometimes they were extremely onerous. Site conditions should be examined and a note made of the electricity supply system. Methods of carrying out financial transactions (including the payment of salaries and wages) should be ascertained. Mr. Flood dealt at some length with the points which should be taken care of in the way of food, drink and health and other personal matters.

Ordering and shipping procedure formed the subject of the next section, particular attention being paid to the correct "phasing" of supplies. Sample letters to shipping agents and manufacturers were given. Advice on the engagement and training of local labour was accompanied by a number of lantern slides showing native workmen carrying out a variety of jobs.

An important section of the paper was that dealing with faults in the design and manufacture of apparatus, which are likely to give more trouble overseas than they do at home. Mr. Flood illustrated his remarks with a number of examples of faulty equipment.

The paper concluded with a description of work carried out by the author's company in Bahrain.

Factory Exhibition

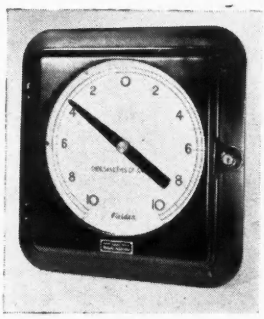
Aids to Increased Productivity

THE fourth Factory Equipment Exhibition was held at Earls Court, London, last week, about 250 exhibitors taking part and occupying some 250,000 sq ft of floor. The exhibition was opened by the President of the Board of Trade, the Rt. Hon. G. E. P. Thorneycroft, and had the support and co-operation of leading trade and industrial associations including the British Productivity Council. Mr. Thorneycroft was thanked at the opening ceremony by Mr. C. M. Vignoles, managing director, Shell Mex & B.P., Ltd.

The theme of the exhibition was " productivity " and the British Productivity Council held a three-day work study conference at Earls Court during the exhibition week, to which all visitors were invited.

Most of the exhibits were of those things which form the background to the working of a factory such as trucks for internal transportation, stationery, towels, partitioning, telephones, fire alarms, clocks and lighting. Considerable attention was given by a number of exhibitors to oil-fired space heating installations and the Gas Council had a large stand showing many appliances for heating, cooking, water heating, etc., in factories. The largest stand in the exhibition was one of 12,000 sq ft staged by the Shell Organisation on the theme of oil fuel in industry. One item on this stand showed the manner in which a diesel generator set could be used in conjunction with waste heat recovery for space or water heating, thus raising the overall efficiency of combustion to a very high level.

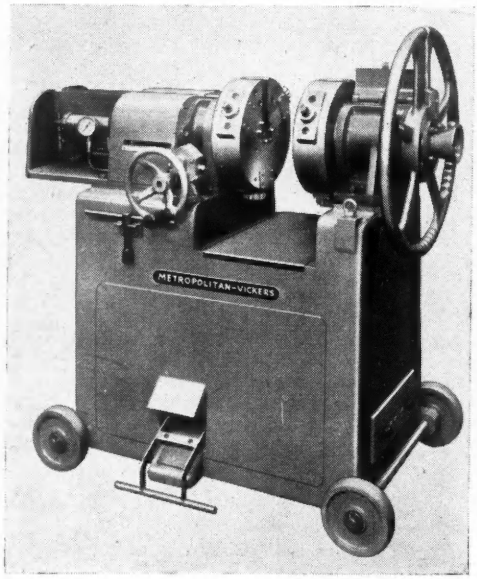
What seemed to be very striking was the almost total absence of an effective statement of the case for electricity in water heating, space heating and cooking. Such electrical exhibitors as were present were primarily concerned with lighting and communication systems, with a few welding machines. One would have thought that with so much space and attention paid to the use of oil fuel that some attempt would have been made by the Electricity Boards to impress upon factory managements the advantages of using off-peak electrical supplies at lower charges for heating purposes of all kinds. Such publicity as there was existed only on the stand of the Electrical Development Association, who by means of films, showed how electricity could improve productivity and had a small demonstration of under-floor heating. It seemed a pity that no actual items of electrical equipment in the heating field could be displayed and one feels that much more vigorous publicity to attract off-peak loads would have been in the best interests of the industry.



Fielden Electronics micrometer indicator

Among the electrical manufacturers the Marconi International Marine Communication Co., Ltd., showed their " Mimco " tape players for music playing and their power megaphone, among other items. Conventional electric or electronic fire alarm equipments were shown by a number of firms including the General Electric Co. and the Pyrene Co. Siemens showed telephone exchange systems, public address equipment and clocks. Among the lighting manufacturers the newly formed A.E.I. Lamp & Lighting Co., Ltd., showed the latest additions to their selection of fittings, an overlamp closed-end vitreous enamelled reflector fitting and a selection from their range of " Module " fittings. Among the new " Osram " fluorescent tubes was the recently introduced 4ft 40 W reflector tube with an internal reflecting layer of titanium dioxide extending over about two-thirds of the tube circumference, giving the advantage that dark ceilings or deposited dirt do not materially affect the level of illumination.

The Harris Engineering Co., Ltd., showed a wide range of electronic air cleaning units and Fielden Electronics, Ltd., demonstrated a number of their industrial instruments, for example, proximity meters which employ the capacity principle for the accurate measurement of a wide range of physical variables, such as the thickness of a metal part, without physical contact. The Metropolitan-Vickers Electrical Co., Ltd., had a good display of welding plant and infra-red heating equipment.



Metropolitan-Vickers wire rope parting machine which simultaneously seals the rope ends

Semi-Conductor Conference

ON 10th April delegates to a three-day conference on semi-conductors, organised jointly by the Physical Society and the British Thomson-Houston Co., Ltd., met at Ashorne Hill, near Leamington, Warwickshire, and on the following day visited the B.T.H. research laboratories for lectures and demonstrations. Nearly 200 physicists and engineers attended, including visitors from America, Canada, Holland, France, Belgium, Denmark and Norway. On the first day the chairman was Prof. H. S. Massey, president of the Physical Society, and the opening lecture was given by Prof. N. F. Mott, president-elect. On the second day the chairman was Mr. L. J. Davies, director of research of the B.T.H. Co., and on the third day the chair was taken by Prof. R. Whiddington, immediate past-president of the Society.

British Electrical Manufacturers

CONTINUED EXPANSION REPORTED

ALTHOUGH the year was one of vicissitude for many sections of the industry, says the Council of the British Electrical and Allied Manufacturers' Association in its report for 1955-56, the overall picture has been one of continued expansion and progress. It is considered to be the duty of the State to provide the most favourable conditions possible for the growth of trade and commerce with the minimum amount of interference; unfortunately, the Government has considered it necessary to intervene in matters vitally affecting industry without sufficient, if any, consultation with industry.

Special reference is made to the Restrictive Trade Practices Bill and the Monopolies Commission. The latter body's reports indicate that in practically every case the industries concerned have shown a sense of responsibility and have established high standards of quality at competitive prices in world trade. In spite of this the Commission has recommended the abrogation of many of the arrangements which have contributed to the industries' well-being; time will show whether this will be in the ultimate interest of the nation.

Generating Plant Production

In its comments on the supply authorities' relations with manufacturers the Herbert Committee on the Electricity Supply Industry appeared to underestimate the role of the Heavy Electrical Plant Consultative Council on which, the B.E.A.M.A. Council says, manufacturers are not in a majority. It points out that the manufacturers have made heavy investments in order to meet the demand for generating plant at home and abroad. If the facilities for producing 200 MW sets for the C.E.A. were not fully used production costs must rise; thus the manufacturers are directly affected by the Herbert Committee's recommendation that the C.E.A. should invite foreign tenders for major power station plant. Mention is also made of the Government's limitation on the electricity supply industry's capital investment programme.

Employment in the electrical manufacturing industry reached the record level of 717,200 last November and in spite of a subsequent decline, mainly in the domestic appliance and radio sections, the year closed with 45,000 more people employed than at the end of 1954.

Export trade reached a new high level of £245 million in 1955, 12 per cent above the previous year's figure. At least a quarter of industry's production is now being sent overseas. It is shown, however, that the shares of the world's markets taken by the United States and Western Germany have increased at a greater rate than that of the United Kingdom. The hazards of export are said never to have been greater than they are to-day. The reasons for what is hoped is only a temporary decline in our share of world electrical trade include restriction of capital investment, high taxation and purchase tax, greater foreign competition, local restrictions and local manufacture.

Western Germany's success is attributed to several reasons including the fact that she has as yet not been seriously handicapped by armament production, and the operation of three shifts by many concerns. The Council says that British deliveries and prices have become more competitive. Prices have been deliberately cut by Continental competitors who must be subsidised in some way. Reference is made to the competition of the Soviet bloc which is expected to increase. British manufacturers, in order to maintain the country's position, have to quote for everything, whereas our competitors "pick and choose" to their great advantage. The British engineering industry consists of a large number of individual concerns. Without co-ordinating individual efforts (the basic object of a trade association) we cannot fight the very large concerns and combines in the export field.

Trade with China

Attention is given in the report to the work of the B.E.A.M.A. Export Panel and the Overseas Committees, of which there are now ten. There is an appreciative reference to the General Agreement on Tariffs and Trade (GATT), and the lessening need for bilateral trade agreements is noted. The Export Panel has expressed the view that the controls on "strategic" exports to China should, at least, be brought into line with the less severe controls imposed on trade with the Soviet bloc. This follows a report that Switzerland and Sweden had contracted to supply generating equipment to China. Electrical exports to China have been almost at a standstill during the last few years but those to the U.S.S.R. have, within the limits imposed, shown an encouraging tendency.

The work of the International Bank for Reconstruction and Development is commented on, particular reference being made to a request for the names of British consultants and specialists to act as advisers to the Bank. It is reported that there has been a slackening in the rate of submissions to the B.S.I.-C.E.A. Approvals Agency but the work is proceeding smoothly and has been speeded up.

Dealing with overseas competition, the report shows that the bulk of the increased West German exports (£175·9 million in 1955) is absorbed by Continental countries. Those of the United States, mainly heavy electrical plant, domestic appliances and telecommunication equipment, go to Latin America and the Middle and Far East territories. Japan's electrical exports (£9 million in 1955) are being affected by rising material and labour costs. Competition is mainly encountered in India, Pakistan and Burma. Reciprocal missions between underdeveloped countries and Japan, well-organised fairs and manufacturing licences from United States firms have helped to boost Japan's manufacturing capacity and output.

It has been reported that the Indian Government is to introduce a Bill this year to establish the use of metric weights and measures. This Bill will affect not only the electrical industry but other industries also and the Federation of British Industries is endeavouring to arrange with the Board of Trade to call a meeting of all interested trade associations to discuss the matter.

The B.E.A.M.A. Council has decided in principle to support the British displays (occupying about five acres) at the Brussels International Exhibition in 1958. The contribution will, it is suggested, take the form of a collective or symbolic exhibit.

A number of other matters relating to export are dealt with in the report and tables give, by classes, British electrical exports in the past three years and a summary of world electrical exports.

It is held that purchase tax and hire-purchase restric-

tions disrupt and reduce production flow and increase costs and therefore prices at home and for export. Domestic appliance manufacturers have been able to counter higher costs by increased efficiency but it is extremely doubtful if this can continue.

The activities of the B.E.A.M.A. public relations service have continued and special reference is made to the promotion of electric traction which, it is noted, is to be the theme of this year's British Electrical Power Convention.

The Council mentions its agreement to the removal of the electrical section of the British Industries Fair from Birmingham to London but says that the decision was made too late to affect the plans of many firms who had prepared their exhibition programmes for 1956. It was doubtful, therefore, whether the 1956 Fair would be fully representative of the industry. But it was agreed that the Fair was worthy of the fullest support by all sides of the industry. The Electrical Engineers' Exhibition was well supported by many member firms; the Association continues to co-operate with the A.S.E.E. through an informal liaison committee. References are made to a number of organisations with which the B.E.A.M.A. is associated.

There has been a tendency to revert to trading with the mutual protection of the B.E.A.M.A. contract price adjustment clause because of further upward movement in prices. There has also been a tendency to shorten the period of validity of firm tender prices. The clause now recommended for common use excludes claims that may arise from default or negligence under a contract.

Work of Committees

Brief accounts are given in the report of the work of the Council committees. The two revised sets of conditions referred to in the last report (IMechE/IEE B1 and IMechE/IEE C) have been completed and are an improvement on their predecessors. The Contract Conditions Committee also mentions negotiations with the Locomotive and Allied Manufacturers' Association on the terms for the supply of diesel-electric and diesel-hydraulic locomotives to the British Transport Commission and to the refusal of the Pakistan Government to consider modifications to its standard conditions.

Activities of the Education Committee have included participation in the I.E.E. Conference on the training of technicians. Recommendations have been made to B.E.A.M.A. members to bring their practice in the matter of payment made to vacation students into line with the rest of the engineering industry.

The Materials Committee refers to the steel shortage. Increased output from British mills has mitigated the shortage of steel sheets, although at the expense of the production of thinner plate, and demand has been reduced. Foreign steel has been imported at high cost although there has been an increase in direct exports of steel. Now export licences are required for steel plates. While it would seem that there is likely to be little or no difficulty in obtaining supplies of hot rolled dynamo and intermediate grades, the position for cold reduced transformer sheet is not good. There is hope of improvement in 1957 and of complete satisfaction of needs in 1958.

The Committee has taken up with the Board of Trade the difficulty experienced by the existence of two prices for copper—that of the Rhodesian Selection Trust and that of the London Metal Exchange. It is said that electrical manufacturers are being forced more and more to examine the possibility of using alternative materials for which prices are more stable and which bear a closer relation to production costs instead of being determined solely by conditions of supply and demand.

The Monopolies (Inquiry) Committee reports that the report of the Monopolies Commission on the electrical machinery industry will probably be published about the middle of this year. The Restrictive Trade Practices Bill has brought about a radical change in the situation and it is difficult to assess its effect on the outcome of the inquiry.

A Nuclear Energy Committee, representative of the member firms engaged in atomic power station equipment, has been set up.

Several pages of the report are devoted to the work of the thirty sections and twenty-seven technical committees of the Association.

The annual meeting at which the report was presented was held yesterday (Thursday).

Restrictive Trade Practices Bill

WHEN the Restrictive Trade Practices Bill was considered in committee the first important amendment, moved by Sir John Barlow, sought to provide that the appointment of the Registrar of Restrictive Trading Agreements should be made by the Attorney-General, and not by the Queen, so that there would be a Minister in Parliament answerable to the House on questions concerning the Registrar's activities.

Many Opposition speakers supported this view, but the President of the Board of Trade, Mr. Peter Thorneycroft, said it was illusory to imagine that there could be debates and questions about these trade practices while they were being discussed and argued in a judicial court. The Registrar would not have discretion about taking cases to the Restrictive Practices Court. All practices subject to the orders made by the President of the Board of Trade would have to be registered and would have to be called up. But discretion was reserved for the President to issue a direction about which group of practices should be registered, and the order in which cases should be heard. If there was a case which involved a social evil which called for early attention or which would set a precedent for many other cases, he could ensure that this was given priority. Beyond that, any system which would make a Minister responsible for answering day to day questions about what was or was not being done by the Registrar would be quite contrary to the principles of the Bill. The amendment was negatived.

Discussing a later amendment, Mr. Thorneycroft answered criticisms that all the facts relevant to a particular trade practice might not be placed before the court. He said that it would be the job of counsel for the Registrar to put all the facts fairly and squarely before the court. The onus would be on the shoulders of the industries or parties who wished to maintain an agreement to show that it was not against the public interest.

After Mr. Ede had said that Parliament must be careful, when reversing the normal burden of proof, to see that the Registrar brought before the court all the relevant facts, Sir R. Manningham-Buller, Attorney-General, said that there was no reason to suppose that counsel conducting a case for the Registrar would not do so in accordance with the highest traditions of British justice and of the Bar.

The Opposition moved an amendment to substitute for the proposed court of law (the Restrictive Practices Court) an administrative tribunal responsible to the President of the Board of Trade and to Parliament. Sir Lynn Ungoed-Thomas, a former Solicitor-General, argued that the matters to be decided were political and economic, but the proposed court was left with these decisions when they should rightly be taken by Parliament.

Mr. Thorneycroft said that, saddled with many responsibilities, he would only be able to give part of his time to study the mass of complicated evidence which would have to be considered if a Minister were made responsible for an administrative tribunal. It would lead to endless delays and stultify the efforts of the Government to deal effectively with these practices. The court should be seen to work with absolute fairness. The amendment was negatived.

INDUSTRIAL NEWS

Electronic Exhibitions Committee

An Electronic Exhibitions Joint Association Committee has been formed and is actively considering the whole question of national exhibition policy in the industries concerned. The associations represented are the British Electrical and Allied Manufacturers' Association, the British Radio Valve Manufacturers' Association, the Radio Communication and Electronic Engineering Association, the Radio and Electronic Component Manufacturers' Federation and the Scientific Instrument Manufacturers' Association.

The R.C.E.E.A. secretariat is acting for the Committee from 11, Green Street, Mayfair, London, W.1.

E.D.A. Public Speaking Competition

In our issue of 9th March we gave the names of the winners of nine Area Board contests in the E.D.A. Public Speaking Competition who will take part in the national finals at the E.L.M.A. Lighting Service Bureau, 2, Savoy Hill, W.C.2. The results in the remaining areas have now been announced. They are as follows:—

Women's Section. East Midlands: Miss B. Jackson (Spalding). South Eastern: Miss J. Charteris (Twickenham). North Western: Miss B. M. Wright (Bolton). North Eastern: Miss S. Smythe (Gateshead). South of Scotland: Miss I. Haines (Lanarkshire).

Men's Section. East Midlands and Midlands (joint contest): Mr. J. G. Page (Grantham). South Eastern: Mr. C. J. White (Hove). North Western: Mr. D. I. Wrigley (Board headquarters). South of Scotland and North of Scotland (joint contest): Mr. R. MacKenzie (Dunoon).

Since our previous notice, it has been decided that the men's finals will now take place on 25th April and will be followed by the women's finals on 26th April.

Coal Distribution Costs Inquiry

The Committee of Inquiry into Coal Distribution Costs has now asked for evidence from producers of fuel and certain organisations representing distributors and consumers. The Committee will welcome evidence from any other source in Great Britain or Northern Ireland and any individual, company or other organisation wishing to give evidence should write to the Secretary, Coal Distribution Costs Inquiry, Ministry of Fuel and Power, Thames House South, Millbank, London, S.W.1.

Among the organisations which have been invited to give evidence are the British Transport Commission, the Central Electricity Authority, the Federation of British Industries, the Industrial Coal Consumers' Council, the Ministry of Fuel and Power, the North of Scotland Hydro-Electric Board, the South of Scotland Electricity Board, the Belfast Corporation Electricity Department, the Electricity Board for Northern Ireland, and the Londonderry Corporation Electricity Department.

Production Exhibition

The Minister of Labour and National Service will open the 1956 Production Exhibition to be held at Olympia from 23rd to 31st May. The main sections of the exhibition will cover scientific research; training and education for management and employees; work study; standardisation; manpower; new methods of manufacture; aids to production; automation; materials and metals; design for production; and trade and technical Press. The conference of the Institution of Production Engineers will be held at the exhibition. Its theme will be the direction of investment into the most appropriate channels leading to higher productivity.

Standby Plant for Australian Newspapers

The *Sydney Morning Herald* and *Sydney Sun* are now produced in a new fourteen-storey building which is Australia's largest publishing establishment. Two Mirrlees/Brush diesel alternator sets provide standby power for the offices and mechanical departments responsible for five million newspapers in seventy-five editions every week. Prime movers for the sets are JS8 eight cylinder, in-line, turbo-charged diesel engines manufactured by Mirrlees, Bickerton & Day, Ltd., Stockport. Each develops 760 b.h.p. continuously at 750 r.p.m. and is directly coupled to a 532 kW alternator manufactured by Brush Electrical Engineering Co., Ltd., Loughborough.

Canadian National Exhibition

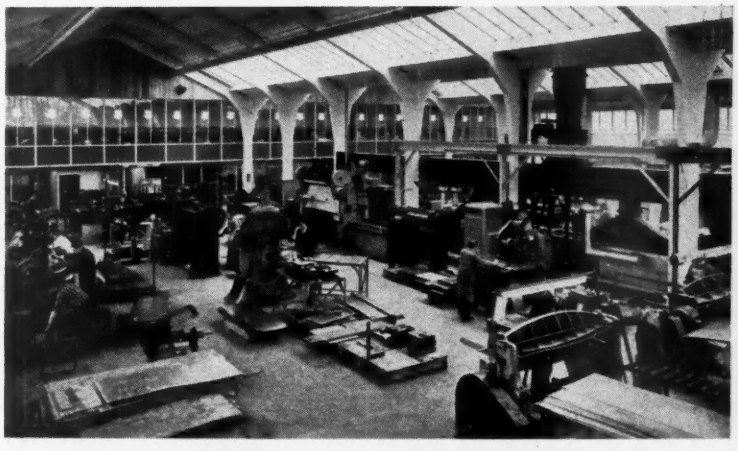
At the Canadian National Exhibition which is being held at Toronto from 24th August to 8th September the British Government will have a stand on which there will be a display illustrating the United Kingdom's scientific and technical achievements since the war. In the display, which is being arranged by the Board of Trade, there will be a model of the Atomic Energy Authority's power station at Calder Hall, Cumberland.

M.P.s Visit Cable Works

Members of the Parliamentary Scientific Committee led by Mr. Austen Albu, deputy chairman, visited the Ocean Works of Submarine Cables, Ltd., on 11th April to see the manufacture of the first transatlantic telephone cables and to inspect the Post Office cableship, H.M.T.S. *Monarch*, which is laying the cables. Captain J. P. F. Betson conducted the visitors over the *Monarch* and Mr. J. N. Dean, chairman and managing director, Mr. F. S. H. Lemon, joint managing director, and Dr. E. W. Smith, director, of Submarine Cables, Ltd., showed the visitors over the factory, assisted by Mr. R. J. Halsey, assistant engineer-in-chief of the Post Office.

New Uxbridge Factory

The new factory of Alfred Imhof, Ltd., at Ashley Works, Cowley Mill Road, Uxbridge, is now in full production, and last week a housewarming party and exhibition was held in conjunction with the R.E.C.M.F. Exhibition. This is now the main factory of the company, which manu-



General view of the new Uxbridge factory of Alfred Imhof, Ltd.

factures metal cases, racks, consoles and accessories for the scientific instrument, radio, electronics and electrical trades, and during the course of the next twelve months further extensions are planned which will eventually house the works now at Islington and Thornton Heath.

The new building is of single-storey construction and occupies a total floor area of 25,000 sq ft. Administration offices overlook the workshop space where approximately 130 people are employed. The architects were Tayler & Green, Lowestoft.

Service Centre Competition

The general display competition for all service centres recently organised by the South Western Electricity Board has been won by Whiteladies Road Service Centre, Bristol. Helston (Cornwall Sub-Area) were placed second, and third place went to Totnes Service Centre (Devon Sub-Area). Ninety centres entered for the competition, which aimed at encouraging interest in display, not only in the window but also in the showroom itself. Judges of the competition were Mr. A. J. Symes, F.R.S.A., and Mrs. Forrest. In the winning display, shown in the accompanying illustration, a clockwork mechanism causes the child in the bath to continuously wash itself with the sponge.

The display at Whiteladies Road Service Centre, Bristol, which has won the South Western Electricity Board's competition

The winning team will later be presented with the Area challenge cup and cheque, and smaller cheques will also be presented to the runners-up.

Brush Group Sales Conference

Practical steps for increasing direct exports by 18 per cent this year were discussed at the third export sales conference of the Brush Group, Ltd., held at Wadham College, Oxford, from 4th to 7th April. Group resident directors and executives from places as far apart as Rhodesia and Australia flew to England especially for the conference. There were more than 80 delegates in all. Current products and the future programme of each factory were reported in turn and considered from the sales point of view in the general discussions which followed. Among those attending the conference were Sir Ronald Matthews (chairman), Mr. G. C. R. Eley (deputy chairman), Mr. Miles Beevor (managing director), Mr. Ian T. Morrow (deputy managing director), who presided at the conference sessions, and Mr. M. C. Clear (group sales director).

The Lighting Load

How the lighting load contributes to system peaks and in shaping daily load curves at peak times was explained by Mr. W. B. Parkinson, B.Sc., A.M.I.E.E., at a recent meeting of the Liverpool Centre of the Illuminating Engineering Society. With the aid of slides and diagrams, he sketched the changes in the characteristics of the lighting load and indicated how, owing to the general development of the uses of electricity, the effect of the lighting component, as a supply problem, had become less serious over the years. The continued improvement in the efficiency of light sources, although a problem at the beginning of the century, had now proved beneficial to suppliers and users alike. There was early promise that the benefits of high standards of illumination could be obtained economically by users on the basis of modern tariffs without any serious repercussions on the engineering and commercial activities of Electricity Boards.

Equipment for Oilfields

Materials and equipment worth £40 million were exported from the United Kingdom during 1955 by the Royal Dutch/Shell Group of oil companies for their operations overseas. This amount was £9 million more than in 1954 and represented about 1·1 per cent of total U.K. exports. In addition £10 million was spent on plant and stores to maintain and improve refineries in this country and £18½ million on the construction, repair and victualling of the Shell tanker fleet.

The equipment and materials sent out for the development of oilfields and markets included a number of unusual items such as corrosion-protected submarine electric cables, the longest of their type in the world, which were designed to connect pump stations standing on platforms in Lake Maracaibo, Venezuela, with a shore power station; and aerial ropeways to transport men and materials to drill oil wells off the coast of British Borneo.

G.E.C. Radio Distribution

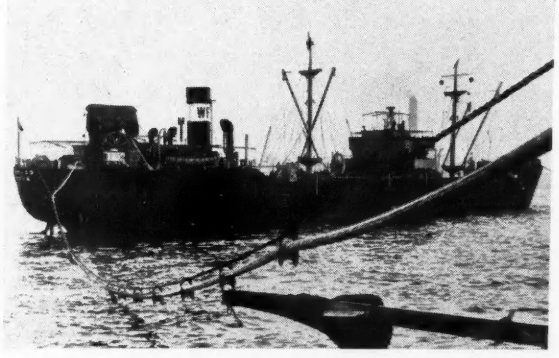
As from 31st May, subject to the sale by wholesalers of such stocks as they may then be carrying, the General Electric Co.'s radio and television products will be available to its approved radio dealers only direct from the G.E.C. sales organisation. The change in distribution policy will be accompanied by a revision of the existing list of approved dealers. It is felt that a reduction in numbers will benefit those retailers who actively identify themselves with G.E.C. radio promotion and will also enhance the value of the company's agency to them.

Proposed New E.T.C.T.A. Branch

An open meeting has been called at Cardiff (Royal Hotel, 25th April, 6.30 p.m.) by the Electrical Trades' Commercial Travellers' Association to discuss the possibility of establishing a South Wales Branch. Mr. R. G. Brandon (president) will be in the chair and all electrical commercial travellers in the area are invited to attend.

B.T.H. Thorne Factory Extension

The building of an extension of the British Thomson-Houston Co.'s factory at Thorne, near Doncaster, began last week. Lord Chandos (chairman of the B.T.H. Co.) was on a tour of inspection of the factory and was invited to lay the first brick. Representatives of the local authority, architects and contractors witnessed the ceremony. The King Edward Road factory at Thorne was originally leased to the company for the manufacture of light-power motors previously produced exclusively at the Coventry works. The works (with a floor area of 33,000 sq ft) entered the



A section of corrosion-protected submarine cable being loaded aboard the cable laying ship Dashwood *in the Thames*

first stage of production in 1951, and in 1955 it was decided to purchase the existing building together with about 8½ acres of land, and to erect an extension of 28,000 sq ft with the object of increasing production by nearly 80 per cent. Part of the land acquired will be used for a boiler house and will also provide a sports field for employees. When completed, equipped, and fully manned, the extension will accommodate another 300 people.

New Pump Factory

On Friday last the Harland Engineering Co., Ltd., inaugurated their new works at Timperley near Manchester. These works comprise a light engineering shop for the batch production of their standard ranges of small pumps, and a spares/service shop which is now the company's headquarters for spares, repairs and service work.

The first impression the new light engineering shop gives is one of light and colour, the walls being cream and green, the machine tools blue-grey and the lifting tackle red. Fork lift trucks are exclusively used for transfer of material and almost all the machines are equipped with hand operated jib cranes.

Batch production of these small pumps is employed and the works has an open-air yard for seasoning castings and a preparatory bay where the castings are shot blasted, dressed and pre-painted. Between the machine and assembly shops there is a finished parts store.

The spares and service section is intended to deal with component parts for the service and maintenance of all Harland pumps and motors and not only those manufactured in the new works. The service department deals with all Harland plant except turbines and includes full scale testing facilities to deal with reconditioned equipment. This is capable of giving flow measurement rates to B.S. accuracy from 10-1,600 g.p.m. and pressure measurements up to 1,000ft head of water.

The company believe that the Timperley works will form a useful and efficient extension to their total manufacturing facilities by providing the despatch service required by customers at home and abroad for their smaller ranges of standard equipment and by giving an efficient post-sales service.

A.S.E.E. Year Book

The 1955-56 edition of the "Year Book and Technical Guide" of the Association of Supervising Electrical Engineers has been considerably enlarged, the technical section, in particular, containing a great deal more information than in previous editions. The first part of the volume is concerned with the Association's activities, its constitution and officers. Reference is made to the council of management, organising committee and officers of the Electrical Engineers (A.S.E.E.) Exhibition, Ltd., and then the remainder of the Year Book (nearly 100 pages) is devoted to technical information likely to be required by supervising engineers.

The Harland light engineering shop showing the spaciously planned arrangement of machines for the batch production of small standard centrifugal pumps

"Servis" Instructional Units

Wilkins & Mitchell, Ltd. ("Servis" washing machines), have recently launched two mobile instructional units, one to tour the North and the other the South of England, holding instructional receptions for authorised dealers and their staffs on "Servis" products. Equipment used at present is a "talkiestrip" projector showing 35 mm colour filmstrips on the history and background of the company, coupled with instruction on how to use and sell both "Servis" washing machine models. The film showings are supported by demonstrations.

Philips' Writ Against A.E.A.

A writ has been issued by Philips Electrical, Ltd., against the United Kingdom Atomic Energy Authority alleging infringement of a patent owned by the company relating to a basic principle in the production of radioisotopes.

Australian Atomic Weapons Range

Instructions have been given to British Insulated Callender's Construction Co., Ltd., by Sir Alexander Gibb & Partners to supply and supervise the installation of an electrical network for the new weapons range at Maralinga, in the South Australian desert. The work in Australia will be carried out in collaboration with British Insulated Callender's Cables (Australia) Pty., Ltd.

New Research Laboratory

Fielden Electronics, Ltd., Manchester, makers of industrial control equipment, are to establish a research laboratory at Bangor. At the Bangor City Council recently, the Town Clerk said the Council was anxious that there should be close association with the Department of Applied Electricity at the University College of North Wales and the new technical college. There was every reason to believe that the enterprise would flourish and that the firm would eventually bring to Bangor a productive unit for the manufacture of industrial equipment.

Boiler Fouling

In the report of the meeting of the Institute of Fuel which appeared in the *Electrical Review* of 30th March reference was made to the relationship between the chlorine content of coal and the fouling of boiler exterior surfaces. In quoting the percentages of chlorine in the cases investigated by Messrs. P. J. Jackson and J. M. Ward the decimal points were inadvertently omitted, so that values as printed were ten times higher than those actually found.

Welding Conference

The first British Commonwealth Welding Conference will be held in London and Saltburn-by-Sea, Yorks, from 17th to 29th June, 1957. The conference fees will be £6 6s for members and £2 2s for ladies accompanying members. Further particulars can be obtained from the Secretary, Institute of Welding (C.W.C.), 2, Buckingham Palace Gardens, S.W.1.

Trade Announcements

The **Maclamp Co.** has moved its factory and showroom to new premises at 29, Park Road East, Acton, London, W.3.

Luxram Electric, Ltd., announce that Mr. J. Emms of 6, Westwood Glen, Tilehurst, Reading, has been appointed as their representative covering Berkshire and Oxford.

DOMESTIC ELECTRICAL EQUIPMENT

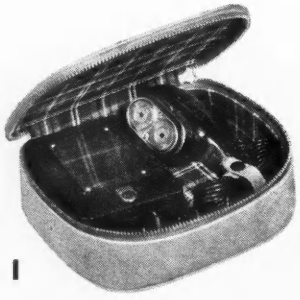
Dry Shavers

ACCORDING to one manufacturer's literature, only 9 per cent of men in Great Britain regularly use dry shavers compared with 40 per cent in America and 30 per cent in Switzerland. From this it seems that a vast potential market exists at present in this country.

Apart from the convenience of being able to shave wherever an electricity supply is available, the dry shaver has several advantages which commend it to the user, the chief of which is the fact that one can dispense with the need for soap, hot water, etc. In all there are a dozen or so different British manufacturers and several include more than one model in their range. Most types are suitable for use on either an a.c. or d.c. supply and cover a voltage range from 100 to 250 V. Battery models for either 6 or 12 V are also available for car owners. For the convenience of the traveller or sportsman who may not be within reach of an electricity supply there is a model with a $4\frac{1}{2}$ V motor operated by flashlamp batteries.

Generally speaking, prices of dry shavers, including purchase tax, range from £4 for the single-head models incorporating a vibratory movement to £10 and over for multi-head types having impulse rotary motors.

Manufacturer	Name or Model	Type	Weight	Voltage Range	Special Features	Finish	Price (excl. tax)	Purchase Tax
ARVIN ELECTRIC, LTD., Fernbrook Avenue, Southend-on-Sea.	"Fernbrook"	Vibrator	25½ oz	200/250 a.c.	New type synchronous pulsating motor. Stainless steel outer shear	Pale grey and burgundy plastic body. Rexine covered steel case	£6 0 1	£1 6 11
	"Consort"	Vibrator. Twin-head	17 oz	200/250 a.c.	Instantly detachable head. Self-aligning cutting shears	Ivory plastic body. Red presentation box	£3 4 0	£0 13 2
	"33"	Dual voltage motor. Triple-head	27 oz	200/250, 100/125 or 12 V a.c./d.c.	"Rhomboid" inner shears. Detachable and interchangeable heads	Ivory and mushroom plastic body. Hide presentation case	£7 11 0	£1 14 6
CHILTON ELECTRIC PRODUCTS, LTD., Hungerford, Berks.	"Kub"	Vibrator	12 oz	210/250 a.c.	Voltage control allows adjustment for drop in mains supply	Light and dark grey "Diakon" casing	£3 7 7	£0 14 10
	"Buk"	Vibrator	14 oz	210/250 a.c.	Voltage control. On/off switch	Ivory urea casing	£4 15 0	£1 2 4
	"Twin"	Vibrator	14 oz	210/250 a.c.	Voltage control. On/off switch	Ivory urea casing	£5 6 7	£1 3 5



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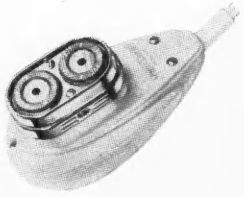

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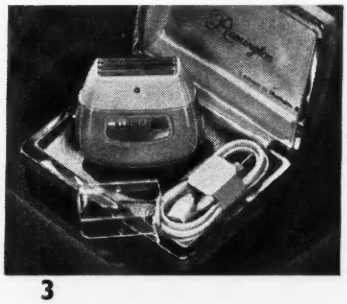

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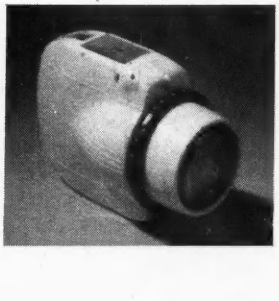

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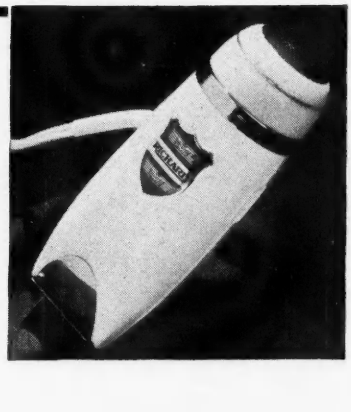

1. *Philips "Philishave" battery model*
2. *Philips "Philishave" mains model*
3. *Remington "Super 60"*
4. *B. H. Ries "Richard Cadet"*
5. *B. H. Ries "Richard Supershaver"*

Manufacturer	Name or Model	Type	Weight	Voltage Range	Special Features	Finish	Price (excl. tax)	Purchase Tax
HAYNOR, LTD., 167, Greyhound Road, London, W.6.	"Unic" 54	Vibrator. Single and dual voltage	11 oz	210/250 a.c. and 210/250 and 100/130 a.c.	Side trimmers	Cream plastic	£4 14 10 (single voltage) £5 1 3 (dual voltage)	£1 1 5 (single voltage) £1 2 9 (dual voltage)
	"Unic" Super Vedette	Impulse motor	11 oz	210/250 and 100/130 a.c./d.c.	12 V models for cars	Cream plastic	£8 14 5	£1 15 7
	"Unic" Selection	Impulse motor	15 oz	110, 125/220 a.c.	Extra large shaving head	Cream plastic	£12 3 6	£2 9 6
PHILIPS ELECTRICAL, LTD., Century House, Shaftesbury Avenue, W.C.2.	"Philishave" 7743	Mains operated	8¼ oz	110/130–200/250 a.c./d.c.	Rotary action. Slide-switch for voltage adjustment	Cream plastic	£6 4 11	£1 9 3
	"Philishave" SC.7749/09	Battery operated	8¼ oz	3 1½ V batteries or, by special adaptor, 6 or 12 V car batteries	Rotary action	Maroon plastic	£8 3 1	£2 1 11
PIFCO, LTD., Pifco House, Watling Street, Manchester, 4.	"Pifco" 1126	Vibrator	9½ oz	200/250 and 100/110	Wafer-thin cutting head. Complete in plastic container	Cream plastic	£3 6 10	£0 14 8
REMINGTON-RAND, LTD., 26-40, Kensington High Street, London, W.8.	"Super 60" Regular	Double-insulated motor	10½ oz	210/240 a.c./d.c.	Contour curved heads. Start wheel	Two-tone grey plastic	£8 6 0	£1 18 3
	"Super 60" Triple Volt	Double-insulated motor	10½ oz	110/130, 140/160 and 190/240 a.c./d.c.	Contour curved heads. Start wheel	Two-tone grey plastic	£9 3 0	£2 1 11
	"60" Regular	Double-insulated motor	10½ oz	210/240 a.c./d.c.	Contour curved heads. Start wheel	Cream and fawn plastic	£7 2 4	£1 13 3
	"New Contour" Regular	Double-insulated motor	10½ oz	210/240 a.c./d.c.	Contour curved heads	Cream and fawn plastic	£6 3 0	£1 6 5
B. H. RIES, LTD., 19-21, Hatton Garden, London, E.C.1.	"Richard Supershaver"	Dual head	12 oz	110/130, 200/250 a.c./d.c.	Enlarged shaving head plus trimming head	"Perspex" body. Leather zip pouch	£7 15 5	£1 13 7

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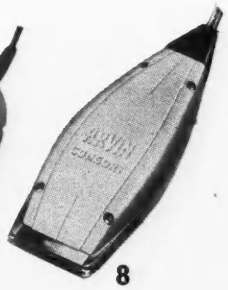

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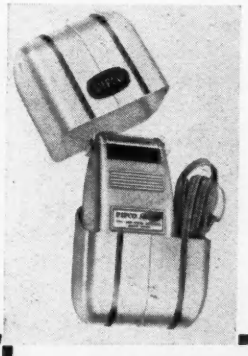

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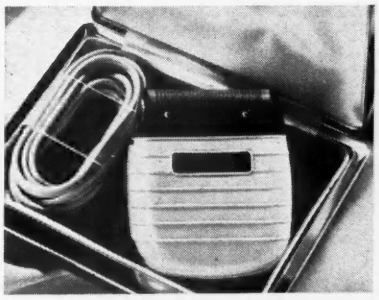

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6. *Remington "New Contour"*
7. *Chilton "Buk"*
8. *Arvin "Consort"*
9. *Pifco shaver*
10. *Arvin "Fernbrook"*
11. *Chilton "Kub"*

DRY SHAVERS . . . . . *continued*

Manufacturer	Name or Model	Type	Weight	Voltage Range	Special Features	Finish	Price (excl. tax)	Purchase Tax
B. H. RIES, LTD., 19-21, Hatton Garden, London, E.C.1. (*continued*)	" Richard Cadet "	Rotary hea	10 oz	110/130, 200/250 a.c./d.c.	Powerful motor, handy size	Ivory plastic body	£5 15 4	£1 3 8
ROLLS RAZOR, LTD., 255, Cricklewood Broadway, London, N.W.2.	" Viceroy " A.C.	Vibrator	10½ oz	200/250 a.c.	Self-starting. Lamp adaptor supplied	Maroon plastic body	£4 10 0	£0 19 9
	" Viceroy " Universal	Impulse motor	9½ oz	90/250 a.c./d.c.	Voltage change switch. Lamp adaptor supplied	Ivory plastic body. Presentation case	£5 13 0	£1 4 10
	" Viceroy " Twin-Four	Impulse motor	11½ oz	90/250 a.c./d.c.	Multi-heads, on/off and voltage change switches. Lamp adaptor supplied	Ivory plastic body. Silk and velvet lined case	£7 7 0	£1 15 0
	" Viceroy " V-Ten	Impulse motor	12 oz	90/250 a.c./d.c.	Angled multi-heads, on/off and voltage change switches. Lamp adaptor supplied	Coffee and deep cream plastic body. Silk and velvet lined case	£8 5 0	£1 19 2
	" Viceroy " A.C.-Four	Vibrator	10¾ oz	100/130 and 200/250 a.c.	Multi-heads, on/off and voltage change switches	Beige and maroon plastic body. Travelling case	£5 15 0	£1 6 9
RONSON PRODUCTS, LTD., 352-3, Strand, London, W.C.2.	" Ronson "	Vibrator	9¼ oz	100/125 and 200/250 a.c.	On/off switch, transparent guard, cool running	Cream and beige moulded body. Presentation case	£7 4 9	£1 12 9
STORR SUPPLIES, LTD., 2c, Balham Road, Edmonton, London, N.9.	" Braun " S.50	Vibrator	6 oz	100/125 and 200/240 a.c.	Self-sharpening cutter blades	Cream	£5 4 9	£1 6 3
SUNBEAM ELECTRIC, LTD., 14-16, Old Quebec Street, London, W.1.	" Shavemaster " W-ZA	16-bar armature motor	12 oz	210/250 a.c./d.c.	5-year guarantee. Self-sharpening single oscillating cutter	Grey plastic and highly buffed steel alloy	£8 16 5	£2 0 3
	" Shavemaster " W-RA	16-bar armature motor	12 oz	100/140, 190/250 a.c./d.c.	5-year guarantee. Self-sharpening single oscillating cutter. Dual voltage	Grey plastic and highly buffed steel alloy	£9 13 5	£2 5 1

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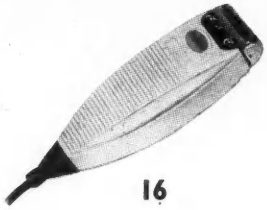

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12. *Rolls Razor " Viceroy " V-Ten*
13. *Sunbeam " Shavemaster " W-ZA*
14. *Ronson shaver*
15. *Rolls Razor " Viceroy " Twin-Four*
16. *Storr Supplies " Braun S.50 "*

Electricity Sales Staffs

FOUR-DAY E.D.A. CONFERENCE IN LONDON

OVER 700 delegates attended the annual conference organised by the British Electrical Development Association for the sales staffs of Electricity Boards which was held in London from Tuesday to Friday last week. At the opening session at the Caxton Hall Mr. D. Bellamy, O.B.E., chairman of the Yorkshire Electricity Board, and deputy chairman, E.D.A. Council, presided, and an address was given by Mr. J. Eccles, C.B.E., deputy chairman (operation), C.E.A., on "Generation Developments—Plans and Prospects," a brief report of which was given in our last issue.

Mr. Eccles said that orders had been placed by the Authority for new generating plant which would provide 50 per cent more electricity per ton of coal than the present average. The plant ordered included 200 MW units to operate at 2,350 lb/sq in and 1,050 deg F, reheating to 1,000 deg F; 70 per cent of the new plant to be commissioned in 1962 would be 200 MW machines or larger.

Dealing with nuclear power, Mr. Eccles said that a possible development from the gas-cooled reactor was the use of liquid sodium for cooling. This would enable coolant temperatures to be increased substantially giving better steam conditions. The pressurised water reactor was also capable of development for power station use. In this design, which was used in the *Nautilus*, the water was pressurised at 2,000 lb/sq in to prevent boiling. In the boiling water reactor (a development from the pressurised water system) water was allowed to boil and supply saturated steam direct to the turbine. In this case, however, there were difficulties associated with the use of irradiated steam. The most advanced reactor for power station use was the homogeneous type in which fuel was employed in the form of a solution of slurry. Under this system continuous chemical processing was possible for the removal of fission products.

Illuminated Ceilings

In the afternoon Mr. J. Gogan (South of Scotland Electricity Board) presented a paper on the lighting of commercial and industrial buildings. Tests carried out by the E.L.M.A. Lighting Service Bureau, he said, had shown that improved lighting could mean increased custom at shops and stores. The main requirements were a large source of even brightness; an adequate level of illumination with absence of glare; and reasonable matching of colour to that of objects viewed under a moderately overcast sky. In Mr. Gogan's opinion these requirements could not be achieved by the more standard methods of lighting technique and they should look to developments in luminous or illuminated ceilings for improved lighting conditions.

The paper was devoted particularly to the "Lumenated Ceiling," consisting basically of a false ceiling of corrugated translucent plastic supported in a framework of lightweight steel and suspended below an arrangement of light sources so that the entire ceiling area was evenly illuminated. The translucent plastic sheet, 0·007in thick and weighing less than 1 oz/sq ft, was made from polyvinyl chloride-acetate copolymer resins, being subsequently re-heat treated at a carefully controlled temperature. The corrugations were achieved by heating and cooling cycles, and the sheet was subjected to an anti-static process to prevent the build-up of a charge which would attract dust. The resultant product gave adequate diffusion and transmission of light with only about 7 per cent absorption.

Mr. J. Eccles giving his opening address to the conference. On his left are Mr. D. Bellamy and Mr. J. I. Bernard

The method of erection was then outlined and the advantages of this form of lighting were summarised. It was particularly useful where an extensive area had to be illuminated. The largest installation to date covered a total area of some 7,400 sq ft, including more than 3,800 sq ft of ceiling over a drawing office, 3,150 sq ft over a component assembly shop and 450 sq ft over an administrative office. The drawing office ceiling provided natural light from glazed roofing and artificial light of approximately 35 lm/sq ft. Such were the possibilities and adaptability of this method of illumination.

Service Centre Planning

Methods of modernisation and reorganisation of service centres formed the subject of a paper on "Planning the Service Centre," presented on Thursday morning by Messrs. E. E. Somake (Dolcis Shoe Co.), A. H. Olson and K. C. White (Courtney, Pope (Electrical), Ltd.). The authors were concerned mainly with the functional side of modernisation and after briefly stating the prime purpose of a service centre, they dealt first of all with the shop front, which they maintained should catch the eye, must identify the function "Electricity is simple and clean," and show displays which would create the urge to enter and buy. The importance of avoiding glare and window reflection was emphasised.

The showroom should be divided into three groups: impulse goods (luxury goods), convenience goods (items of standard quality, use and popularity) and demand goods (necessities). On-the-spot demonstration facilities and a demonstration theatre were desirable. The authors then dealt with furnishings and behind-the-scenes operations, including the planning of receiving and delivery departments, and the adequate and comfortable accommodation of personnel.

Turning to engineering services, they said that the

electrical installation should be most modern and flexible and be used as one of the demonstration facilities. Heating should be by means of electricity or at least electrically controlled by thermostats. Properly designed colour schemes could be the simplest and most economical way of changing the character, atmosphere and apparent proportions of an interior.

A large part of the paper dealt with lighting in which the authors described light sources and equipment, the characteristics and colour rendering of light sources, and general lighting.

The whole of the interior of the showroom should be regarded as a large exhibition hall, and displays should be strategically placed so that customers entering the showroom for advice or payment of accounts were routed past the various displays, ensuring that the widest possible range of merchandise was presented. Wherever possible the item of merchandise should be shown in the surroundings for which it was intended, so as to enable the prospective purchaser to visualise this particular item in his home or office.

Effects of Automation

Mr. L. Landon Goodman, in a paper entitled "Automation and its Social and Economic Implications," thought that loose talk and writing in the use of the word "automation" was resulting in some difficulties with labour relations. There were few examples of complete automation extant in industry to-day.

The benefits of automation would be a furthering of those consequent on industrialisation, and he gave an impressive list of these. Men could have more leisure, larger real incomes and better and safer working as layouts improved and dirt was eliminated. It was important to remember that large mass-production concerns knew that they could not long survive if they started any sort of mass unemployment, as a large output depended on a large consumption.

Automation could result in the export of "automated" equipment and the products of automated factories. There would be intense international competition to meet in the latter field, but our skill and ingenuity should keep us to the fore in supplying the capital equipment of automation.

Small companies would probably be forced to use centralised research and development facilities, because of the amount of technical knowledge involved in such work, to apply automation to their products. In training, men with a broader view of industry would be required and a by-product of automation should be the partial overthrow of the cult of the specialist. Management charts would be flatter for there would be fewer levels between the top and bottom man in a company.

The author gave examples of the work that some specialised automatic devices could accomplish in offices, banking, baking, etc., with the use of computers, and concluded that there were no grounds whatever for the gloomy prophecies which had been advanced recently in some quarters about future social consequences.

Meeting Competition

The paper by Mr. W. G. Chilvers, A.M.I.E.E. (North Western Electricity Board) on "Organising to Meet Competition" began by defining the nature of competition which was not only with other forms of fuel but with anything which made a demand on the consumer's purse. Competition, with due regard to social considerations, was desirable and so was expenditure upon advertising although it might be cut for political reasons. The spur of competition within the industry itself was a good thing, applied with reason. As to the "share of the public purse," he showed that only about 4 per cent of consumers' expenditure was accounted for by fuel and light; in 1946 23·4 per cent of consumer expenditure on fuel was on electricity and by 1954 this had risen to 25 per cent. This was thought to be due largely to new consumers and that for existing consumers the percentage had gone down. It was still the fact that while electricity consumption had advanced the sales of its main competitors had remained static.

Mr. Chilvers referred to the efficiency claims of electricity's rivals in the domestic field which for a time had to remain undisputed, but when the sales organisation was allowed to perform its proper functions it had achieved results. He went on to discuss the nature of this organisation and the functions of the district and sub-area staffs; the sub-areas could best carry on some of the specialist services.

After devoting attention to "consumer relations" and the need for co-operation with electrical contractors the author turned to the education of staff and consumers. There was a passing reference to selling conditions in which it was suggested that the electricity supply industry was handicapped by lack of freedom in fixing selling prices for appliances.

In dealing with the industrial load, Mr. Chilvers mentioned the advantages derived by the gas industry from its development centres, and the serious competition of oil. The need for more power sales engineers was stressed. In the matter of space heating the author called for more information on loadings and running costs and wondered why there could not be off-peak tariffs throughout the country more directly related to the actual incremental cost of producing energy at night-time.

A clear policy statement on commercial cooking was needed to assist manufacturers of equipment and doubts about the desirability of developing this load should be removed.

Smokeless Zones

Mr. Philip Honey, A.M.I.E.E. (technical liaison officer, E.D.A.), presented a paper on "The Place of Electricity in a Smokeless Age." He began by giving a short history of attempts to abate atmospheric pollution, ranging from John Evelyn's "Fumifugium" (1661) to the Clean Air Bill now before Parliament. He went on to enumerate and describe the causes and dangers of pollution, naming the domestic coal fire as the chief offender but also condemning railway smoke and oil-engine exhausts. A table showed the contributions made to pollution by various uses of coal; this showed, *inter alia*, that although the coal consumption of electric power stations had practically doubled between 1938 and 1948 the amount of smoke produced had remained the same.

The author gave analyses of coal and oil emissions and mentioned the deleterious effects of sulphur compounds. Methods of measuring smoke deposits and sulphur-dioxide were touched upon and instances were given of readings in various places. Mr. Honey said that it seemed that in districts where the power station was the only large possible source of atmospheric pollution SO_2 in no way reached an excessive concentration. As atomic energy came into the picture the total SO_2 emission produced by the Central Electricity Authority must obviously get less and less. He referred to carbon monoxide pollution and thought that this provided a strong reason for replacing petrol-engined delivery vans or trucks by electric vehicles.

The effects of smoke in terms of damage to health and property were reviewed and the recommendations of the Beaver Committee on Air Pollution were commented upon.

There followed a summary of the provisions of the Clean Air Bill.

In a section on smokeless zones reference was made to the excessive smoke produced by the lighting up of domestic coal fires and attention was called to forms of electric firelighters now available or under development which got over this trouble; suggestions were made for other forms.

Mention was made of the limited availability of solid smokeless fuels, the growth of the use of oil fuel and the production of gas and gas coke. In dealing with gas supply Mr. Honey quoted an Institution of Gas Engineers paper suggesting that a larger proportion of women in the younger age groups were using electric cookers than among the older women. Gas prices had been raised to a point at which it was being " priced out of the market." Other fuels were cheaper or, as in the case of electricity, cleaner or more satisfactory or convenient to use.

The author predicted that in the next ten years the use of solid fuels would decline, oil would be increasingly used to supplement the country's fuel supplies and electricity supply would continue to expand encouraged by the need to change over to smokeless methods. In the matter of electric heating, however, more attention would have to be paid to the thermal insulation of buildings.

On Friday there was a general discussion at the Connaught Rooms, followed by luncheon at which Mr. Bellamy, who presided, congratulated Mr. J. I. Bernard, chief technical officer, E.D.A., on the organisation of the conference and thanked the speakers and all those who had taken part. Mr. Eccles emphasised the importance of sales staffs being fully knowledgeable about what they sold.

Blackpool Promenade Lighting

First Section of New Installation Completed

THE promenade at Blackpool, famous throughout the world for its bright lights, is being re-lit at an average cost of £12,000 per mile. On 11th April, to mark the completion of the re-lighting of the principal section, representatives of local authorities in the north inspected the new installation at the invitation of the Mayor of Blackpool, Alderman Charles Dunn, J.P., and the Council.

The scheme has been planned by collaboration between the Highway Committee and the illuminations and public street lighting officer, Mr. H. Carpenter, and his senior assistant, Mr. K. T. O. Cox. A special new vertical type decorative lantern (the " Blackpool ") has been designed by the General Electric Co., Ltd.

It was necessary to provide lighting along the carriageway which would be capable of speedy adaptation into colourful decorative lighting during the Blackpool Illuminations season. To meet this requirement, and to provide high efficiency lighting, tubular fluorescent lamps were chosen. The use of shorter tubes enabled a smaller lantern to be designed which would be better able to withstand the force of the winds at Blackpool.

The " Blackpool " lantern is a vertical decorative unit suitable for housing four, six, or eight 2ft 40 W " Osram " new warm white fluorescent tubes. All sheet metal parts are of copper and provision is made for a special split box to house a 50 A connector box for use during the Illuminations. The lanterns are used as post-top units for the Promenade Walk and as double arm units for the carriageway, and each 8-lamp lantern has a light source of about 10,500 lumens.

The lanterns along the Promenade Walk each house eight fluorescent tubes. They are mounted at a height of 21ft on spun-concrete columns supplied by the Stanton Ironworks Co. A system of opposite mounting has been adopted and steel columns supplied by Stewarts & Lloyds, Ltd., provided with eye hooks for festoon lighting at heights of 19ft 6in and 22ft, have been erected along the east side. The columns and poles carry at a mounting height of 26ft double-arm brackets to each of which are attached two " Blackpool " lanterns. Simple colour screens are added for decorative lighting. Switch start units are installed for these lanterns because the supply voltage which is now 200 V will be increased later to 240 V, and it will be possible to re-set the tapped transformers incorporated in them. Time switches and auxiliaries for the scheme were supplied by the British Thomson-Houston Co., Ltd., Philips Electrical, Ltd., and Sangamo Weston, Ltd.

The re-lighting of the promenade is an important part of a programme, being undertaken over a period of about ten years, for the re-lighting of Blackpool. The approved capital expenditure for work completed and in hand is £314,683, with approximately £90,000 to be budgeted for in future. The work involves the conversion to electricity of all the existing gas lighting.

A daylight view of Blackpool Promenade showing the new G.E.C. "Blackpool" lanterns installed as double-arm units along the carriageway and (right) a night view of the West Promenade Walk

Financial Section

STOCKS and SHARES

STOCK EXCHANGE markets will no doubt remain unsettled, for the time being, while investment business, pent up in advance of the Budget, begins to flow again along the channels considered to be indicated by the Chancellor's proposals. Up to the eve of Budget day the industrial markets remained firm, as the accompanying lists show, but it was the gilt-edged market which made the more confident approach. Prominent in the company news were excellent results from Vickers, who are raising the dividend for 1955 from 8½ to 10 per cent out of increased earnings; and, also, from the cable manufacturing group.

T. C. & M. Results

Annual results published by Telegraph Construction & Maintenance were well received in the market, the £1 shares being marked up initially to 30s. With the distribution for 1955 maintained at a total of 8½ per cent (of which the final 4¾ per cent applies to capital increased by about a million through new issues) the yield on the shares became 5⅝ per cent. Trading profit is reported to have advanced by more than a half, and although substantially larger charges are made against it for depreciation, research and taxation, the net surplus still shows a £58,000 improvement at £252,000. In the review circulated with the accounts, there is a hint that more capital may have to be raised because of the financial strain arising from the high prices of commodities (particularly copper), and from the effects of the credit squeeze.

Aberdare Dividend

In the preliminary profits statement published by Aberdare Cables (Holdings), the figures are not strictly comparable with those of the previous year (ending in October) because of subsequent acquisitions of outside interests in subsidiaries. Nevertheless, the increase in net earnings from £221,000 to £318,000 made a strong impression, and the maintenance of the dividend at a total of 17½ per cent, on larger capital, was up to expectations. The 5s shares improved to 13s, at which they yield 6¾ per cent.

Dewhurst and Partner

Dewhurst & Partner 2s ordinary shares changed hands at over 12s (the official quotation remained at 11s 3d) after news of the company's proposal to make a share-for-share scrip issue through the capitalisation of part of the reserves. The operation will raise issued ordinary capital to £360,000, and bring it into better alignment with the size of the assets now employed by the company. It is hoped that allotment letters will be posted on 27th April, and that the issue will be completed in time for the interim dividend for the current year to be based on the increased capital. Annual results of the company have recorded

Price Changes in

Company or Board	Nom. Value	Middle price 16th Apr.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1955 Highest	1955 Lowest
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	76½		3	3	3 18 6	94¾	76½
Brit. Elec. 1974/77	100	74½		3	3	4 0 6	93⅛	75½
Brit. Elec. 1976/79	100	79½x.d.	—	3½	3½	4 8 0	98⅜	80½
Brit. Elec. 1974/79	100	89½	+1	4¼	4¼	4 15 0	109	90½
Overseas Electric Supply								
Calcutta Elec.	£1	20/-	+3d	6†	6†	6 0 0†	22/6	20/9
East African Power	£1	20/9	−3d	7	7	6 15 0	24/6	19/9
Nigerian Elec.	£1	20/9	+6d	10	10	9 12 9	27/-	21/-
Palestine Elec. "A"	£1	21/-		Nil	Nil	Nil	22/9	21/-
Perak Hydro-Elec.	£1	16/-		10	10	—	22/3	17/9
Equipment and Manufacturing								
Aberdare Cables	5/-	13/-	+1/-	17½	17½	6 14 6	14/6	11/-
Aeralite	1/-	5/3		88⅛	45*	8 11 6	6/9	5/3
Allen, W. H.	£1	70/-	+2/-	20	20	5 14 3	83/9	74/6
Aron Elec. Ord.	£1	54/3		15	15	5 10 6	63/9	55/6
Assd. Automation	10/-	27/-	+1/-	10	10	3 14 0	32/-	11/-
Assoc. Elec. Ord.	£1	67/6	+1/3	14	15	4 9 0	96/-	62/6
Automatic Tel. & El.	£1	62/6		15	15*	4 16 0	79/6	60/-
Babcock & Wilcox	£1	78/9	+4/3	12*	15	3 16 3	98/-	68/6
Baldwin, H.	2/-	4/3		20	20	9 8 6	5/6	4/4
Bakelite	10/-	26/6		16	16	6 0 9	34/6	27/-
Berry's Electric	5/-	6/-		—	10‡	8 6 8	—	—
British Aluminium	£1	52/6	+6d	12	12	4 11 6	58/-	35/3
B.I. Callender's	£1	50/6		10	12½‡	4 19 0	55/3	44/9
B.I. Callender's 6% Pref.	£1	22/-		6	6	5 9 0	26/6	21/9
British Thermostat	5/-	26/3	+9d	27½	27½	5 4 9	35/-	22/6
British Vac. Cleaner	5/-	7/-		30	15*	10 14 6	10/-	6/6
Brook Motors	10/-	39/6	−6d	20	25	6 6 6	47/-	39/9
Brush Ord.	5/-	7/-		6	10	7 2 9	9/6	7/6
Bulgin, A. F.	1/-	7/3	+3d	45	50	6 18 0	8/-	4/-
Burco Dean	5/-	8/9		—	22½	12 17 0	17/3	12/-
Chloride El. Storage "A"	£1	66/3	+9d	12½	17½	5 5 9	77/6	58/6
Clarke Chapman	£1	97/-	+3/3	20	22½	4 12 9	102/6	68/9
Cole, E. K.	5/-	16/9		27½	17½*	5 4 6	25/6	18/3
Cossor, A. C.	5/-	7/9	+6d	10	15	9 13 6	14/-	8/9
Crabtree	10/-	28/6		20	20	7 0 3	34/6	27/6
Crompton Parkinson Ord	5/-	14/9		20	16*	5 8 6	19/9	15/-
De La Rue	5/-	18/9	−9d	20	30	8 0 0	26/-	17/-
Decca	4/-	29/6	+6d	56¼	43¾*	5 18 9	48/9	31/-
Desoutter	5/-	26/6		25	30	5 13 3	35/-	25/6
Dewhurst	2/-	11/6	+6d	24	30	5 4 3	11/3	7/3
Dictograph Tel.	2/-	6/3		20	20	6 8 0	9/3	9/6
Dubilier Condenser	1/-	4/3		25	25*	5 17 9	5/7	3/1
E.M.I.	10/-	28/9	−9d	10	15	5 4 3	37/-	25/3
Electrical Components	5/-	13/9		20	25	9 1 9	21/3	13/9
Elec. Construction	£1	27/3		15	8½	6 4 6	41/3	28/9
Enfield Cable Ord.	£1	17/-		Nil	Nil	Nil	25/3	18/6
English Electric	£1	57/6		12½	12½	4 7 0	86/9	54/3
English Electric 3¾% Pref.	£1	13/3		3¾	3¾	5 13 3	16/9	14/-
Ericsson Tel.	5/-	38/-		25†	25*†	3 5 9†	46/6	29/-
Ever Ready	5/-	29/-	+1/6	40	35*	6 0 9	38/-	2/3
Falk Stadelmann	£1	37/6	−6d	15	17½	9 6 9	52/6	42/-
G.E.C. Ord.	£1	57/6		12½	14	4 17 3	80/3	51/3
G.E.C. 6½% Pref.	£1	22/9		6½	6½	5 14 3	28/4	23/6
General Cables	5/-	13/6	+6d	30	30	11 2 3	17/-	15/-
Greenwood & Batley	£1	46/3		17½	17½	7 11 3	57/6	45/-
Hackbridge Cable	5/-	23/9	+1/-	20	25	5 5 3	23/9	14/-
Hackbridge & Hewittic	5/-	17/9		25	30	—	24/9	17/-
Heatrae	2/-	4/9		12½	15	6 6 3	5/9	4/3
Henley's	10/-	16/9	+9d	10½	10½	6 5 6	21/3	15/9
Holophane	5/-	17/6		25	30	8 11 6	19/9	16/-

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.

* After scrip issue. † Free of income tax. ‡ Dividend forecast

expansion in almost every one of the years since it was made public in 1948. While the rate of dividend has been raised by stages, the bulk of the earnings has been going back into the business, and establishing in the process the reserves from which the scrip issue is now to be made.

British Aluminium Capital

Shareholders of British Aluminium have received advance notice of an issue of about two million ordinary shares, by way of rights, the details to be announced later. This will supply part of the £7 million to be contributed towards financing the first stages in the erection of the aluminium smelter in Quebec. Of that sum, £3 million is being obtained in the form of bank loans, the intention being to fund these over the next few years by issues of loan capital. Other sums are being raised in Canada. A meeting for the approval of the proposals is being held after the annual general meeting on 8th May.

Electrical Investments

Company or Board	Nom. Value	Middle price 16th Apr.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1955 Highest	1955 Lowest
Equipment and Manufacturing—continued						£ s d		
Hoover	5/-	27/6	+1/6	70	50	9 1 9	52/6	35/6
I.C.I.	£1	45/9	+6d	15	10*	4 7 6	61/9	38/3
Intl. Combustion	5/-	19/6	+6d	25	20*	5 2 6	24/6	16/-
Johnson & Phillips	£1	40/-	+1/3	15	15	7 10 0	52/6	39/6
Lancashire Dynamo	£1	43/9	+1/9	15	11*	5 0 6	56/5	37/3
Laurence, Scott	5/-	13/9		20	12½*	4 11 0	19/6	14/6
Lister, R. A.	£1	30/-	+1/3	9·3	10	6 13 3	40/-	28/9
London Elec. Wire	£1	51/3	−6d	10	12½	4 17 6	61/3	50/6
Lucas, J.	£1	34/3	+9d	7½	7½	4 7 6	56/6	38/9
Marryat & Scott	2/-	9/9	+6d	25	30	6 3 0	13/-	9/6
Mather & Platt	£1	55/6		13·4*	15	5 8 0	75/-	48/-
Metal Industries	£1	16/9	−3d	9	9	—	38/-	25/-
Midland Elec. Mfg.	£1	45/-	+1/6	10	12½	5 11 0	55/-	44/-
Morphy-Richards	4/-	22/6		35	50	8 17 9	35/-	27/-
Murex	£1	64/6	+1/3	15	20	6 4 0	67/6	49/3
Newman Ind.	2/-	2/3	−3d	10	10	8 17 9	3/6	2/4
Oldham & Son	1/-	2/6		17½	20	—	3/6	2/1
Parnall (Yate)	5/-	7/-		8	14	10 0 0	13/2	7/3
Parsons, C. A.	£1	80/-		10	10	2 10 0	100/-	56/-
Plessey	10/-	68/9	−2/6	27½	30†	4 7 3	89/-	55/-
Pye "A" Deferred	5/-	17/-	+1/3	20	12½*	3 13 6	32/9	14/3
Revo	10/-	10/9	+3d	9	9	8 7 6	15/6	12/6
Reyrolle	£1	100/-	+2/6	15	16½	3 5 0	127/6	89/-
Rheostatic	4/-	12/9	−3d	22½	18½*	—	14/3	9/3
Richardsons Westgarth	5/-	15/-	+6d	15	16⅔	5 11 0	19/-	11/-
Scottish Cables	4/-	15/9	−6d	27½	27½	6 19 9	22/6	16/3
Smith (England), S.	4/-	12/6	−3d	17½	17½	5 12 0	20/-	14/9
Southern Areas	£1	23/9	+1/3	7½	10	8 8 6	38/-	27/6
Strand Elec.	5/-	7/9	+3d	17½	15*	9 13 6	13/3	7/6
Sturtevant	5/-	26/3	+3d	18·9†	14·4*†	2 14 6†	35/9	21/-
Sun Elec.	£1	36/-		15	20	11 2 3	35/-	33/9
Switchgear & Cowans	5/-	14/6		20	25	8 12 6	17/-	11/-
Taylor Tunnicliff	5/-	12/-	+9d	15	15	6 5 0	16/3	11/3
T.C.C.	10/-	40/-x.d.		25	25	6 5 0	53/9	41/-
T.C. & M.	£1	30/-	+6d	8½	8½	5 13 3	40/9	29/3
Telephone Mfg.	5/-	6/9		10	10	7 8 3	11/6	7/9
Thorn Elec.	5/-	18/-		20	15*	4 3 6	33/-	13/9
Thornycroft	£1	42/6		15	15*	7 1 3	48/9	34/6
Tube Investments	£1	60		22½	14*†	4 13 3	62/6	55/-
Vactric	5/-	13/9	+1/3	10	15*	—	—	—
Veritys	5/-	6/9		12½	12½	9 5 3	12/2	7/-
Walsall Conduits	4/-	11/9		70	70	—	17/3	12/-
Ward & Goldstone	5/-	32/6	+6d	50	30*	4 12 3	45/-	32/6
Watford	2/-	6/9		25	25	—	8/9	6/3
Westinghouse Brake	£1	77/6		18	18	4 12 9	110/-	82/-
West, Allen	5/-	13/6	+3d	17½	15*	5 11 0	16/6	8/-
Wolf Electric	5/-	19/6		20	20	5 2 6	26/3	16/1
Trusts, Transport and Communications								
Anglo-Am. Tel.:								
A. Ord.	100	75		6*	6	8 0 0	88	67½
Ord.	100	50	+1	3½	3½	7 10 0	54½	45
Anglo-Portuguese	£1	21/3		8	8	7 10 6	27/-	21/-
Brit. Elec. Traction:								
Def. Ord. "A"	5/-	18/-	+6d	50	22½*	6 5 0	24/3	19/-
Cable & Wireless:								
Ord.	5/-	10/6		10	10	4 15 3	13/6	10/-
4% Loan	100	91		4	4	4 8 0	100	92/-
Calcutta Trams	£1	23/6		6†	7½†	6 7 9†	26/9	20/-
Cape Elec. Trams	£1	18/9		5½	7½	8 0 0	19/6	16/6
Marconi Marine	£1	31/6		10	10	6 7 0	41/3	31/3
Oriental Tel. Ord.	1/-	81/-	−2/-	16	—	—	102/6	72/6
Telephone Rentals	5/-	10/6	+3d	10	12½	5 19 0	13/6	9/6

Dividends Declared

Sydney S. Bird 4s shares rose sharply to 6s 6d following the preliminary profits statement for 1955. Despite a trebled tax charge of £91,000, the net surplus has risen further from £31,000 to £88,000, and appears to exceed by five times the amount of the 15 per cent dividend for the year. The latter is equivalent to the previous rate, allowing for a subsequent scrip issue, and goes to capital increased also by a rights issue of shares. Yield on the shares works out at over 9¼ per cent. Lancashire Dynamo are bringing the total distribution for last year to 11 per cent, which represents an increase of 1 per cent on capital increased since last year by a one-for-two scrip issue.

British Columbia Power

Expansion is evident throughout the annual report published by the British Columbia Power Corporation, whose shares are officially quoted in London and are popular with home investors interested in sound Canadian securities. They stand at a little over $70, at which the yield on the present rate of dividend is only about 3 per cent, but may be considerably improved in effect by the operation of double tax relief on dividends. Main points in the latest report include the statement of a 16 per cent rise in the demand for electricity. Earnings come out at nearly $7 million, equal to just over $2 per share, as compared with $1·62 in the previous year, and the dividend is raised to $1·20.

Copeland & Jenkins

The final dividend of 8 per cent declared recently by Copeland & Jenkins, the makers of mica plates for use with electrical and electronic equipment, brings the total to 14 per cent for the period of just under twelve months to last December. This is the rate forecast in the prospectus issued at the time of the marketing of the shares a year ago. A profit of £172,000 (before tax) compares with a figure of not less than £160,000 then estimated. Following the announcement, the price of the 10s ordinary shares was raised to 15s, at which level the yield exceeds 9¼ per cent. Capital of the company is made up of £300,000 in ordinary and £150,000 in preference stocks.

REPORTS and DIVIDENDS

The Telegraph Construction & Maintenance Co., Ltd.—The accounts for 1955 show a group surplus of £726,359, as compared with £465,036 for 1954. From this is deducted depreciation, £205,955, research and development expenditure, £130,702, and interest on debentures of a subsidiary, £294, and after adding income from investments, etc., the group profit before taxation is £536,530. After taxation and other adjustments, the net balance attributable to the T.C. & M. Co. is £250,361 (against £216,155), to which is added £105,993 brought in, making £356,354 available. Reserves receive £95,000 and it is proposed to pay a final dividend of 3¾ per cent on £2,974,596 ordinary capital, and a cash bonus of 1 per cent, which with the interim dividend of 3¾ per cent paid on capital of £1,954,092, maintains the distribution for the year at 8½ per cent. The consolidated balance carried forward is £197,048.

In his statement which accompanies the report and accounts, Mr. J. N. Dean (chairman and chief executive) says that there has been a further substantial increase in turnover, but the business is extremely competitive and the profit rates are keen. Nevertheless the trading surplus of the group has risen by 56 per cent. All branches and companies of the Metals Group have operated profitably during the year, though in every case production, and therefore profit, has been restricted by shortage of supplies of raw materials, notably nickel. Last year he reported that it was hoped that the situation would be relieved by the end of 1955, but this hope has not been fulfilled, yet demand for the group's products has been substantially increased, so that the order book has become an embarrassment.

With regard to cables, the current year started with a healthy order book for all classes of cable, but it is feared that the Chancellor's pressure on public authorities, in particular the Central Electricity Authority, to reduce expenditure, may involve somewhat of a recession in demands for power cable until after the Budget. The plastics division has made good progress and despite difficulties in the first quarter, due to "settling down" in the new premises at Farnborough, it succeeded in making up for lost time in the remaining quarters by increasing the year's turnover by 20 per cent. There is every reason to believe that 1956 will show further improvement.

Submarine Cables, Ltd., jointly owned with Siemens Brothers & Co., Ltd., has had a year of great activity and the order book is full at least until mid-1957. The first of two transatlantic cables was completed in August, 1955, and was laid by the Post Office cable ship H.M.T.S. *Monarch*. The second cable is now under construction at Erith, and when completed further important telephone cable of similar construction will be manufactured.

Dealing with overseas activities, Mr. Dean refers to the arrangement with Canada Wire & Cable Co., Ltd., and the General Cable Corporation of the U.S.A. to found in Canada a company, Telecables & Wires, Ltd., to manufacture telephone cables. They will have a holding of $200,000 out of a total capital of $2,000,000.

A. H. Hunt (Capacitors), Ltd.—The report and accounts for 1955 now issued confirm the preliminary figures given in our issue of 6th April.

In his statement which accompanies the report and accounts, Mr. S. H. Brewell (chairman and managing director) says that increases in turnover in all sections of the home market, supported by an all-time record in exports, helped to counteract ever increasing manufacturing costs and shrinking profit margins. The new factory at New Addington has progressed well; the original section is now complete with all major items of plant installed and in operation. With reference to Hunt Capacitors (Canada), Ltd., the problems in connection with setting up a production unit proved more difficult than was originally anticipated and whilst considerable output figures were achieved during 1955, the overall volume was not sufficient to meet operating costs.

They commenced the trading in the New Year with an encouraging order book and their increased facilities gave them every reason to anticipate further increased turnover. At this date it is virually impossible to estimate what effect the credit squeeze and additional restrictions on hire purchase will have on certain sections of the business.

A. Reyrolle & Co., Ltd.—In his circulated statement covering the past year, Sir Claude Gibb (chairman) says that there has been a substantial rise in the volume and value of output, which were the highest ever achieved. Although not quite a record the value of orders received was greater than the previous year in spite of keen competition. Trading has become still more difficult but the company is pressing forward with designs introducing new techniques, many of which are already being favourably received. Recent progress in design and improved methods of production are helping to counter competition and to maintain their share in the world's markets. The developments made possible by the skill of their engineers and the greatly increased capacity of research equipment at their disposal are bearing fruit in the shape of substantial orders at home and overseas for large circuit-breakers operating at voltages up to 275 kV. As a result of extensive research they are in a position to supply switchgear for 330 kV and 380 kV for major transmission systems overseas and in the United Kingdom. This progress has been achieved without detriment to new designs for switchgear operating at lower voltages. An interesting example in this field is the manufacture of 11 kV air-break switchgear for use in an underground switch-chamber at a hydro-electric station.

In conjunction with their associates, C. A. Parsons & Co., Ltd., and a number of other well-known engineering concerns, they have formed the Nuclear Power Plant Co., Ltd., for the design and construction of power plants for the production of electricity using fissile material as a primary fuel. A year ago it seemed that Reyrolles would participate by supplying their standard products in the form of main and auxiliary switchgear, but the field of activities has been extended and now includes the equipment which will be required for the control of reactors. Progress in the construction of the light engineering shop and the roadway under the railway, referred to last year, has been good. The supply of the many materials required for the manufacture of their products is still not without difficulty on the score of delivery and rising prices. Plant recently installed in the South African company's factory at Johannesburg should be in full production this year.

A.E.I., Ltd. (Victoria).—The Melbourne correspondent of the *Financial Times* reports that the operating company of A.E.I., Ltd., Victoria, Australian Electrical Industries Pty., had a consolidated net profit of £A462,300 for the 13 months to 31st October last. A.E.I., 70 per cent of whose capital is held by Associated Electrical Industries of the United Kingdom, is the holding company for the group, formerly known as Australian General Electric Pty. The profit, which is after an undisclosed tax charge, is the first since part of the holding company's share capital was placed with the public last October. The directors expected to pay an interim dividend about next July. A dividend was distributed in May last, but under the terms of the placing no final dividend for the 13 months' period will be recommended. The profit for the period is lower than the record equivalent figure for 1954 of £A543,355, but is better than any previous result.

Aberdare Cables (Holdings), Ltd.—After providing £307,932 for taxation, the group profit is £317,780 for the year to 31st October last, as compared with £220,671 for 1953-54. The issued capital was increased during the year from £987,430 to £1,200,667 by issues against acquisitions of outside interests, and the profit figures are not strictly comparable due to the acquisitions. It is proposed to pay a final dividend of 10 per cent, again making 17½ per cent for the year.

(*Continued on page* 649)

FINANCIAL SECTION (*continued*)

The British Aluminium Co., Ltd.—To provide approximately £7,000,000 for the first stages of its Canadian aluminium smelter, the company has arranged for United Kingdom bank loans of £3,000,000. It is proposed to raise the balance by a rights issue of approximately £2,000,000 £1 ordinary shares.

An extraordinary general meeting will be held on 8th May (after the annual meeting) to consider resolutions increasing the capital to £12 million by the creation of 5 million £1 ordinary shares and extending the directors' borrowing powers. There will be an earlier meeting (23rd April) of holders of the 3 per cent mortgage debenture stock to consider the necessary modifications of the trust deeds securing the stock.

Lancashire Dynamo Holdings, Ltd., have declared a final dividend of 7 per cent on the ordinary stock, making a total of 11 per cent for the year ended 31st December, 1955 (equivalent to 16½ per cent on ordinary stock before the issue of one share for every £2 stock held). The net profit of the group amounted to £584,554 (1954—£540,262) from which is deducted taxation of £313,401 (1954—£283,872) and to which is added taxation provisions of previous years no longer required £14,665, leaving a balance available for appropriation of £285,818 (1954—£256,390), less £176 minority interests and £11,851 retained in subsidiary companies. The annual meeting is on 5th June.

G. & J. Weir, Ltd.—The group profits for 1955 are £3,045,254, as compared with £3,064,916 for 1954, and after deducting £1,471,579 for taxation, the net balance is £1,573,675 (£1,534,486), of which £1,059,397 is attributable to the parent company. Reserve receives £700,000 and it is proposed to pay a final dividend of 22½ per cent, making 30 per cent for the year (unchanged). The previous year's 2½ per cent diamond jubilee bonus is being consolidated into the dividend.

Sydney S. Bird, Ltd., report that after providing £91,832 for taxation, the group net profit for 1955 is £87,763, as compared with £31,346 for the preceding year. It is proposed to pay a dividend for the year of 15 per cent on capital raised by a 100 per cent scrip issue and further by a one-for-two rights issue. The dividend on the old capital for 1954 was 30 per cent.

New Companies

Thomas Watson (Electrical Engineers), Ltd.—Registered 27th March. Capital £2,000. To acquire the business of an electrical engineer and motor car component factor carried on by John H. Furphy at Stockton-on-Tees as "Thomas Watson's"; and to carry on the business of manufacturers of and dealers in dynamos, motors, armatures, etc. Directors: J. H. Furphy and Valentine Ida Furphy. Regd. office: 58/60, Parliament Street, Stockton-on-Tees.

Cossor Communications Co., Ltd.—Registered 29th March. Capital £100. Inventors, designers and manufacturers and repairers of and dealers in apparatus and equipment for telecommunications, etc. Regd. office: Cossor House, Highbury Grove, N.5.

Neon Accessories, Ltd.—Registered 7th February. Capital £100. Manufacturers, importers and exporters of and wholesale and retail dealers in all kinds of electrical and neon signs, etc. F. S. Pollard, 8, Lyon Meade, Stanmore, Mdx, is the first director. Regd. office: 291, Grays Inn Road, W.C.1.

Liquidations

Morris (Litherland), Ltd., electrical engineers.—Winding up voluntarily. Liquidator, Mr. E. S. Browne, 41, North John Street, Liverpool, 2, appointed 27th March. Particulars of claims to the liquidator by 30th April.

Underwood (Electric), Ltd.—Winding up voluntarily. Liquidator, Mr. C. N. Smellie, 30, Cornhill, London, E.C.3, appointed 27th March.

NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates do not clash with others already arranged

Monday, 23rd April to Friday, 4th May

LONDON (OLYMPIA) AND BIRMINGHAM (CASTLE BROMWICH).—British Industries Fair.

Monday, 23rd April

BIRMINGHAM.—James Watt Institute, Great Charles Street, 6 p.m. I.E.E. South Midland Radio & Telecommunication Group. Annual general meeting, followed by "F.M. Broadcasting and Reception," by H. E. Farrow.

LEICESTER. — E.M.E.B. Demonstration Theatre, Charles Street, 6 p.m. I.E.S. Leicester Centre. Film show.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Radio & Telecommunication Section. Informal evening on "Electronics and Automation." "Automatic Assembly Systems for Electronic Equipment," by G. W. A. Dummer (with films and demonstrations).

MANCHESTER.—College of Science & Technology, 6.30 p.m. Institution of Production Engineers, North Western Region. "The Factory Acts and How they Affect Engineering Establishments," by Sir George Barnett.

Tuesday, 24th April

BELFAST.—Lombard Café, Lombard Street, 6.45 p.m. I.E.E. Northern Ireland Students' Section. Annual general meeting.

EDINBURGH.—11, Atholl Crescent, 7.30 p.m. Edinburgh Electrical Society. Annual general meeting, followed by film show.

LEEDS.—1, Whitehall Road, 6.30 p.m. I.E.E. North Midland Graduates' & Students' Section. "Air Break Contactors," by G. F. Shields.

LONDON.—I.E.E. London Graduates' & Students' Section. Visit to Waterloo Signal Box, S.E.1, at 6.45 p.m.

Savoy Hotel, W.C.2, 12.30 for 1 p.m. British Electrical Development Association. Annual luncheon, followed by annual general meeting.

85, Minories, E.C.3, 5.30 p.m. Institute of Marine Engineers. Annual general meeting.

May Fair Hotel, Berkeley Street, W.1, 11 a.m. Institution of Chemical Engineers. Annual corporate meeting, followed at 12 noon by President's address, "The Technological Awakening," by J. A. Oriel, and 7 for 7.30 p.m., annual dinner.

Manson House, Portland Place, W.1, 6.30 for 7 p.m. Society of Instrument Technology, London Section. "Dynamic Characteristics of some Neutralisation Processes and of Glass pH Electrodes," by Prof. Ir. H. Kramers. (Joint meeting with Control Section.)

Wednesday, 25th April

CHESTER.—5, Kings Buildings, King Street, 7 p.m. Society of Instrument Technology, Chester Section. Annual general meeting.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Supply and Measurement Sections. "Physical Properties and Impulse Strength of Paper," by H. C. Hall and K. Kelk, "The Impulse Strength of Lapped Impregnated Paper Dielectric," by H. C. Hall and D. J. Skipper and "Breakdown Under Impulse Voltages of Solid and Liquid Dielectrics in Combination," by W. G. Standring and R. C. Hughes. (Joint meeting.)

Connaught Rooms, Great Queen Street, W.C.2, 12.30 for 1 p.m. Institute of Fuel. Annual luncheon.

School of Hygiene & Tropical Medicine, Keppel Street, W.C.1, 6.30 p.m. British Institution of Radio Engineers, London Section. "Radio and Television Interference—its Growth and Effects," by M. Smith.

NORTHAMPTON.—College of Technology, 7.15 p.m. Northampton & District Electrical Association. Annual general meeting.

Thursday, 26th April

BRISTOL.—The University. I.E.E. Bristol Graduates' & Students' Section. "Electronic Counters," by H. Inston.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. Institution of Electrical Engineers, ordinary meeting. Kelvin Lecture: "Radio Astronomy," by Prof. A. C. B. Lovell.

At the Royal Society of Arts, John Adam Street, W.C.2, 5.15 p.m. Royal Society of Arts, Commonwealth Section. "The Snowy Mountains Scheme," by C. M. Gray.

NOTTINGHAM. — E.M.E.B. Demonstration Theatre, Smithy Row, 6 p.m. I.E.S. Nottingham Centre. "Outdoor Illuminations," by H. Carpenter.

Gas Showrooms Lecture Theatre, 6.15 p.m. Institute of Fuel, East Midland Section. Annual general meeting, followed by film show.

Friday, 27th April

BIRMINGHAM.—Regent House, St. Philip's Place, Colmore Row, 6 p.m. I.E.S. Birmingham Centre. "Blackpool Illuminations," by H. Carpenter.

Imperial Hotel, 7.30 p.m. Incorporated Plant Engineers, Birmingham Branch. "Atomic Energy," by Dr. J. H. Fremlin.

LONDON.—1, Birdcage Walk, S.W.1, 5.30 p.m. Joint meeting of the Institutions of Civil, Mechanical and Electrical Engineers. Graham Clark Lecture: "The Impact of Engineering on Society," by Sir Maurice Bowra.

Connaught Rooms, Great Queen Street, W.C.2, 6.45 for 7.15 p.m. Junior Institution of Engineers. Annual dinner.

NOTTINGHAM.—Bell Inn, 7.30 p.m. Institution of Works Managers, Notts & Derby Branch. Annual general meeting and supper.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 0d each including postage) will be obtainable after 25th April from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1951

10821. National Research Development Corporation.—Electronic circuits for digital computing systems. 28th April, 1952. (748333.)

12510. Hell, R.—Method of transmitting electrically pictures, drawings, texts or the like. 28th May, 1951. (748262.)

21334. Weber, L.—Electric smelting of iron ores. 10th September, 1951. (748334.)

1952

4400. Bendix Aviation Corporation.—Information storage assemblies of the magnetic type. 19th February, 1952. (748266.)

5874. Standard Telephones & Cables, Ltd.—Information handling equipment. 27th February, 1953. (748336.) 5875. Equipment for recording or reproducing information on an elongated recording medium. 6th March, 1953. (748337.)

6580. Bendix Aviation Corporation.—Digital differential analyser. 13th March, 1952. (748267.)

24748. Vigren, S. D., Broberg, W. O. W., and Zander, R. A.—Arrangement of electromagnetic control magnets preferably for electric switching apparatus. 2nd October, 1952. (748218.)

30471. Hoover, Ltd.—Squeeze driers. 27th November, 1953. (748128.) 30474. Washing machines. 27th November, 1953. (748129.)

30630. Parsons & Co., Ltd., C. A.—Infrared gas analysing apparatus. 30th November, 1953. (748162.)

1953

3409. English Electric Co., Ltd.—Electrical rectifier circuits. 5th May, 1954. (748275.)

3670. Cole, Ltd., E. K., New, A. W. W., and Levi, J. E.—Ion trap magnet assemblies. 10th February, 1954. (748132.)

3917. Hartley Electromotives, Ltd.—Equipment for use in the installation of electrical wiring in buildings. 18th February, 1954. (748277.)

5447. Staatsbedrijf der Posterijen, Telegrafie en Telefonie.—Electronically controlled synchronous electromotor. 26th February, 1953. (748343.)

5530. English Electric Co., Ltd.—Engine electric transmission systems for rail vehicles. 26th February, 1954. (748344.)

5956. General Electric Co., Ltd.—Apparatus for periodically sampling electric signals. 3rd June, 1954. (748278.)

6567. Philips Electrical Industries, Ltd.—Microphones. 10th March, 1953. (748136.)

7231. General Electric Co., Ltd., Power, E. B., and Rigden, S. A. R.—Apparatus for agitating a suspension. 16th March, 1954. (748175.)

8165. Simplex Electric Co., Ltd.—Electrical busbars and connectors therefor. 24th March, 1954. (748280.)

9387. Reyrolle & Co., Ltd., A.—Gas blast electric circuit-breakers. 7th July, 1954. (748225.)

12457. Henley's Telegraph Works Co., Ltd., W. T., and Hubbard, H.—Casing for electrical terminal connector blocks. 4th May, 1954. (748284.)

13726. Tok Electrical & Industrial Mechanisms, Ltd., and Philpott, S. F.—Cam operated electric switches. 13th August, 1954. (748286.)

13781. Burndept, Ltd.—Battery lamps. 17th May, 1954. (748143.)

14798. Donat, E.—Electromagnetically maintained pendulum devices. 27th May, 1953. (748290.)

17788. English Electric Co., Ltd.—Electric oil circuit-breakers. 25th June, 1954. (748293.)

18198. Thorpe, Ltd., F. W., and Thorpe, F. W.—Electric lampholders for use with fluorescent lamps. 1st October, 1954. (748148.)

18230. British Thomson-Houston Co., Ltd.—Glow discharge switches for use with electric-discharge tubes. 1st July, 1953. (748184.)

18968. Simmonds & Stokes (Niphan), Ltd.—Electric plug and socket cable couplings. 21st June, 1954. (748150.)

20282. Wayne Kerr Laboratories, Ltd., Calvert, R., and Mayo, C. G.—Transformers. 21st July, 1954. (748230.)

28720. Telefunken Ges.—Screening of high frequency apparatus. 19th October, 1953. (748195.)

29368. British Thomson-Houston Co., Ltd.—Means for ascertaining the presence of moisture. 25th October, 1954. (748235.)

30586. Ericsson Telephones, Ltd., and Distin, L. S.—Electromagnetic relays. 5th November, 1953. (748313.)

31057. Dunlop Rubber Co., Ltd.—Multiway electric tumbler switch. 26th October, 1954. (748314.)

32238. English Electric Co., Ltd.—Manufacture of gyroscopes. 19th November, 1954. (748198.)

33470. Philco Corporation.—Printed electric circuit construction. 2nd December, 1953. (748241.)

33997. British Thomson-Houston Co., Ltd.—Electrical coils. 15th November, 1954. (748242.)

35294. Philips Electrical Industries, Ltd.—Radiation pyrometers. 18th December, 1953. (748317.)

1954

2165. Technicolor Motion Picture Corporation.—Recording and reproducing colour television. 25th January, 1954. (748201.)

2830. Wild-Barfield Electric Furnaces, Ltd.—Production of atmospheres for the gaseous cementation of ferrous alloys. 30th December, 1954. (748320.)

4340. Schloemann Akt.-Ges.—Semi-continuously operating electrode presses. 15th February, 1954. (748245.)

8989. B.M.A.C., Ltd.—Electric plug and socket connectors. 7th September, 1954. (748168.)

11534. Philips Electrical Industries, Ltd.—Getter holders. 21st April, 1954. (748202.)

12584 and 6. Babcock & Wilcox, Ltd.—Vapour generating and superheating units and the operation thereof. 30th April, 1954. (748322/3.)

13466. Abbey, A. (Lermont, B.).—Brush holders for electrical apparatus. 7th May, 1954. (748324.)

14726. General Electric Co.—Transistor integrating circuits. 19th May, 1954. (748204.)

17228. International Electronic Research Corporation.—Electronic tube clamp and shield. 11th June, 1954. (748253.)

18534. Schmid, W. K.—Electromagnetically controlled driving mechanism. 24th June, 1954. (748255.)

19199. General Motors Corporation.—Evaporators of refrigerators. 30th June, 1954. (748206.) 19200. Refrigerator. 30th June, 1954. (748207.)

19508. Vigren, S. D., Broberg, W. O. W., and Zander, R. A.—Electromagnetic control magnets. 2nd October, 1952. (748256.)

26017. Sperry Corporation. — Phase modulation circuit. 8th September, 1954. (748257.)

27010. Standard Telephones & Cables, Ltd.—Resonant vibrating systems. 17th September, 1954. (748258.)

32692. General Electric Co.—Vacuum cleaners. 11th November, 1954. (748330.)

Australian Electrical Trade

Australia's imports of dynamo-electric machinery and electrical appliances and equipment during the Commonwealth financial year ended June, 1955, showed a small increase on the previous twelve months, the total value being £A28,719,000 compared with £A25,920,000. The advance was accounted for largely by communication equipment, heating and cooking appliances, and unspecified machinery and apparatus. On the other hand there was a noteworthy decline in transformers and rectifiers and dynamo-electric machinery other than motors. The accompanying table compares the values of the principal groups during the two years.

IMPORTS

Class of Equipment	Year ended June, 1955 £A (000)	Inc.or dec. on year ended June, 1954 £A (000)
Batteries and accumulators ...	410	− 14
Cable and wire, covered ...	1,847	− 46
Communication equipment, including radio	3,868	+ 1,435
Electric motors	3,125	+ 215
Other dynamo-electric machines	3,182	− 763
Heating and cooking appliances	1,335	+ 786
Sparking plugs and parts ...	604	+ 69
Other ignition equipment for i.c. engines	320	+ 42
Lamps, bulbs, tubes, etc. ...	1,630	+ 662
Measuring and recording instruments	828	+ 363
Protective equipment ...	752	+ 210
Regulating, starting and controlling apparatus	5,035	+ 562
Transformers and rectifiers	2,874	− 1,474
Other electrical machinery and apparatus	2,909	+ 752

Exports of dynamo-electric machinery and appliances and equipment totalled £A2,326,000 in value in the year ended June, 1955, compared with £A1,960,000 in 1953-54. Batteries and accumulators accounted for £A453,000 (£A432,000) and communication equipment for £A694,000 (£A554,000).

New E.A.W. Branch

The Calcot Branch of the Electrical Association for Women was formed at a meeting on 23rd March, when the following officers were appointed: chairman, Mrs. V. Heron; hon. secretary, Mrs. J. Batchelor; hon. treasurer, Mrs. D. Milbourne; and magazine secretary, Mrs. Guinan.

GENERATION AND DEVELOPMENT

Hackney Power Station

On Saturday last Hackney "B" generating station was officially opened by the Mayor of Hackney, Councillor H. Foxon, J.P. This station, which was fully described in our issue of 12th August, 1955, will ultimately accommodate five 30 MW turbo-alternators. Two of these are now in commission and the third set should be on load some time during next year. Before the final two sets can be erected the remainder of the old Hackney "A" station will have to be demolished and extensions made to the civil engineering works of the "B" station.

At the opening ceremony Mr. H. V. Pugh, controller of the London Division of the Central Electricity Authority, introduced Mr. J. Eccles, deputy chairman (operation) of the C.E.A., who said that the conception of the new station was due to the Hackney Borough Council and Mr. E. A. Mills (the former borough electrical engineer), the designer. After the Mayor had unveiled a commemorative plaque in the turbine room the station was dedicated by Canon Colin Cuttell. The guests then toured the station and subsequently had afternoon tea in the control room, where they were able to see one of the sets synchronised and put on load. As a memento of the occasion the Mayoress was presented with a radio receiver.

Temporary 11 kV Joint

To facilitate work on 11 kV overhead lines, particularly where pole changing is involved and where alternative supplies to hamlets are not available, the South Western Electricity Board has been using polythene insulated cable laid on the ground across the section of the line concerned. Whereas 500 yd lengths of cable can be accommodated on a drum size suitable for transport purposes and for laying out along the edge of a field, it has been found that this length is insufficient for some of the maintenance jobs encountered.

The simplest method of jointing two 500 yd lengths together is to secure the conductors in a parallel groove clamp, while the simplest method of insulating the joint is to use the air and keep the bare conductors a safe distance apart.

To achieve this, the Sterling Cable Co., which has supplied the Board with emergency cable in the past, has constructed to the design and instructions of Mr. G. O. McLean, chief engineer of the Board, a simple two-piece pole which is shown in the accompanying illustration and which can be erected and put into commission in less than five minutes.

Electricity in the Lake District

"The time has now come, after all these amenity battles, when we must take the commonsense view and see that these valleys get electricity as soon as possible." This statement was made by Mr. W. Bannister, the Lancashire County Council's representative, when the subject of electricity supplies was once again debated at a meeting of the Lake District Planning Board.

An amendment that about a mile of line in the Langdale Valley should be laid underground received only two votes, and the matter was left to the discretion of the Development Control Committee. Mr. C. J. Bulman, who lives in the valley, said that the residents wanted electricity as soon as possible. They were as keen on amenity as anyone else, but they were prepared to have some of the line above ground if necessary.

The Board decided to send a strong protest to the Minister of Fuel and Power over delay in approving the provision of an electricity supply for Deepdale. Mr. K. Dobell said that nine months ago the Planning Board had approved a scheme for a supply, partly by overhead line and partly by underground cable. The National Parks Commission, however, wanted more of the line underground.

Floodlighting in London

Public buildings in London are to be floodlit this year from 30th April to 30th September. Floodlighting will be daily, from lighting up time until midnight. The following buildings are included in the scheme:—Nelson's Column and Trafalgar Square, National Gallery, Admiralty Arch, Admiralty Old Building, Carlton House Terrace, Horse Guards, Houses of Parliament (Terrace only, and only during the Parliamentary recess), Tate Gallery, Somerset House and the Tower of London. Electricity will be supplied free by the London Electricity Board.

Recent C.E.A. Contracts

Contracts have been placed by the Central Electricity Authority during the past month for power stations, transforming stations and transmission lines amounting in the aggregate to £9,498,258. The principal contracts include the following:—

Acton Lane "B" power station: Structural steelwork.—Redpath Brown & Co.

Northfleet: Two 120 MW reheat turbo-generators, condensing and feed heating plants.—General Electric Co. River works.—Taylor Woodrow Construction.

Poole: 132 kV switchgear.—A. Reyrolle & Co.

Drakelow "B": Superstructure. —J. Gerrard & Sons.

Staythorpe: 132 kV switchgear.—General Electric Co.

Willington: 275 kV switchgear.—British Thomson-Houston Co.

Lincoln: Two cooling towers.—William Moss & Sons.

Rugeley "A": Initial site works.—Sir Alfred McAlpine & Son.

Blyth "A": Auxiliary transformers.—Yorkshire Electric Transformer Co.

Agecroft "B": One 120 MW turbo-generator, condensing and feed heating plant. —Metropolitan-Vickers Electrical Co.

Spennymoor substation: Two 75 MVA, 132/66 kV transformers.—Ferranti.

Legacy and Oswestry substation: 132 kV switchgear.—Ferguson Pailin.

Calder substation: Four 30 MVA, 132/11 kV transformers.—C. A. Parsons & Co.

Aintree substation: Two 60 MVA, 132/33 kV transformers.—Ferranti.

Bushbury and Smithwick substation: Uprating switchgear.—General Electric Co.

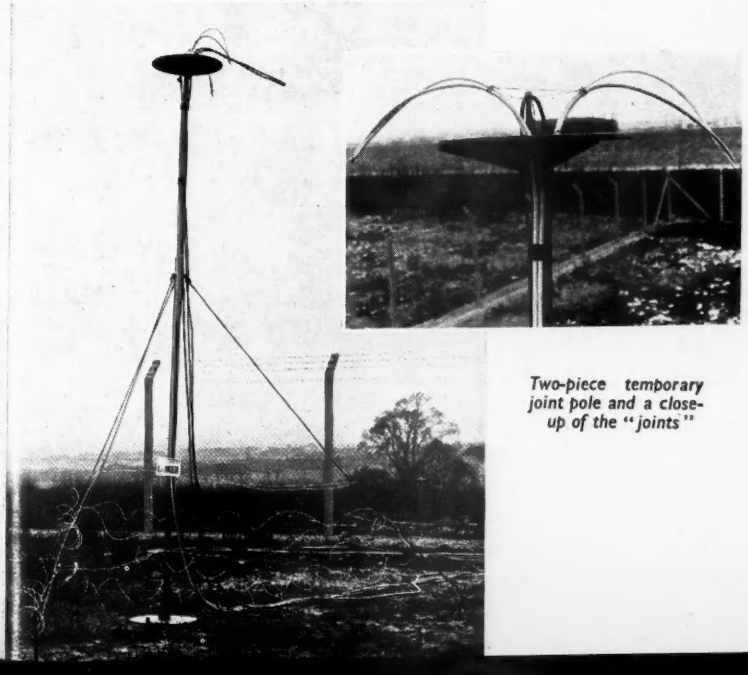
West Weybridge substation: 132 kV switchgear.—A. Reyrolle & Co.

Fraddon-Rame: 132 kV overhead line.—British Insulated Callender's Construction Co.

Uskmouth-Ebbw Vale/Gloucester: 132 kV overhead line.—J. L. Eve Construction Co.

Crossings of Rivers Severn and Wye: 275 kV overhead line.—J. L. Construction Co.

Marchwood-Andover: 132 kV overhead line.—Pirelli-General Cable Works.



Two-piece temporary joint pole and a close-up of the "joints"

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia.—1st May. Commonwealth of Australia. Insulated cables. (E.S.B. 9674/56. Ten/18871.)*

2nd May. Council of the Municipality of Hay, N.S.W. Distribution transformers. (E.S.B. 9475/56. Ten/18878.)*

4th July. State Electricity Commission of Queensland. Carrier current communication equipment. (E.S.B. 9391/56. Ten/18879.)*

Barrowford.—4th May. U.D.C. Electrical installations in 24 two-storey flats on the Higher Causeway Estate. Surveyor, Council Offices, Barrowford, Nelson, Lancs.

Birmingham.—30th April. Public Libraries Committee. Electrical installation in King's Heath Public Library, High Street, 14. Sir Herbert J. Manzoni, city engineer, Civic Centre, 1.

Burma.—Union Purchase Board. 4,800 torch bulbs. (E.S.B. 9242/56. Ten/18801.)* 26th April. 1,400 lamp brackets with holders. (E.S.B. 9388/56. Ten/18828.)* 30th April. Ten starter star delta air brakes. (E.S.B. 9442/56. Ten/18873.)*

Canada.—26th April. Saskatchewan Power Corporation. Two electrically driven water pumps for Boundary Dam power station. (E.S.B. 9236/56. Ten/18812.)*

Edinburgh.—North of Scotland Hydro-Electric Board. 132 kV transmission line. (See this issue.)

Farnworth.—7th May. Borough Council. Electrical installations in 70 houses. (See this issue.)

Formosa.—9th May. Central Trust of China, Purchasing Department. Power station equipment including switchgear panels, primary fuse cutout, lightning arrestors, 250 kVA transformers, cables, etc. (E.S.B. 9463/56 I.C.A. Ten/18867.)*

Greece.—25th April. Ministry of Finance. 600 V insulated electric cable. (E.S.B. 9181/56. Ten/18790.)*

2nd May. Six radio-telephony stations. (E.S.B. 9183/56. Ten/18843.)*

Huntingdon.—4th May. County Council. Street lighting equipment. (See this issue.)

India.—2nd May. Director General of Supplies and Disposals. Cables. (E.S.B. 9376/56. Ten/18834.)* 8th May. Three sets of electrically-driven pumps. (E.S.B. 9375/56. Ten/18817.)*

15th May. Bombay Electricity Board. 66 kV transmission lines. (E.S.B. 9356/56. Ten/18870.)*

31st May. Government of Madras Electricity Department. Outdoor and indoor switchgear for Villupuram-Neiveli substations. (E.S.B. 9487/56. Ten/18836.)*

25th June. Hindustan Steel, Ltd., Calcutta. Power plant for steelworks at Rourkela including three 25 MW condensing turbo-generators and one back-pressure set. (E.S.B. 1682/56. Ten/18881.)*

Iraq.—30th April. Directorate General of Municipalities. Generating set and transformers. (E.S.B. 9315/56. Ten/18806.)*

Morley.—19th May. Borough Council. Street lighting equipment. (See this issue.)

New Zealand.—30th May. General Post Office. Insulated telephone cable. (E.S.B. 9342/56. Ten/18831.)*

Pakistan.—10th May. Karachi Port Trust. Electrification of the East Wharf. (See this issue.)

St. Austell (Cornwall).—30th April. County Council. Electrical installation in old people's home, Sedgemoor Priory. (See this issue.)

South Africa.—26th April. City of Johannesburg, Stores and Buying Branch. Insulated electric cable. (E.S.B. 9832/56. Ten/18897.)*

2nd May. Stores Department, South African Railways. 250 magneto telephones. (E.S.B. 8871/56. Ten/18781.)* 4th May. Telegraph line material. (E.S.B. 8872/56. Ten/18815.)* 9th May. Cable. (E.S.B. 9562/56. Ten/18856.)* Underground cable. (E.S.B. 9564/56. Ten/18855.)* Cables. (E.S.B. 9563/56. Ten/18885.)*

3rd May. Union Tender and Supplies Board. 3,000,000 insulated steel staples. (E.S.B. 9214/56. Ten/18795.)* 10th May. Mercury arc rectifier equipment. (E.S.B. 9216/56. Ten/18819.)*

Southern Rhodesia.—2nd May. City of Bulawayo Electricity Department. 11 kV, 250 MVA switchgear, battery and charger, d.c. switchgear and cables. (E.S.B. 9154/56. Ten/18793.)* Overhead line material. (E.S.B. 9148/56. Ten/18791.)* Insulated and bare copper conductors. (E.S.B. 9147/56. Ten/18792.)*

United States.—3rd May. Director of Purchases, St. Pauls, Minnesota. Two 500 kW turbo-generating sets. (E.S.B. 9632/56. Ten/18932.)*

Uruguay.—16th August. Administracion General de las Usinas Electricas y los Telefonos del Estado. 150 kV substations for the Montevideo Collector Systems and extension of the Rincon del Bonete substation. (E.S.B. 9498/56. Ten/18883.)*

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

ORDERS PLACED

Durham.—City Council. Supply and erection of 121 mercury vapour street lighting units on trunk road.—B. L. Oliver (Birtley).

Exeter.—Lighting and Cleansing Committee. Improved lighting in New North Road and other thoroughfares (£8,166).—Revo Electric Co.

Heston & Isleworth.—Works, Baths and Fire Brigade Committee. Recommended. Improved street lighting in Lampton Road and Heston Road (£7,651).—Harland & Wolff.

London.—Paddington Borough Council Works Committee. Electric street lighting in various districts as part of the 1956-57 programme for the conversion of lighting from gas to electricity (£13,014).—Harland & Wolff.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Barnsley.—Houses (45), Intake estate; W. Dunk and Sons, Ltd., builders, 72a, Eldon Street.

Bexhill-on-Sea.—Houses (54), Southlands Road estate (£77,000); Knight Bros. (Brighton), Ltd., builders, 19, Bristol Gardens, Brighton, 7.

Birmingham. — Works reconstruction (£9,000,000); Birmingham, Tame & Rea District Drainage Board, Rookery Park, Erdington.

Blackburn.—Factory at Whitebirk Drive, to be occupied by Tufted Machinery Co., Ltd., Blackburn; borough engineer.

Cardiff.—College of Domestic Art, Llandaff; Staverton Builders, Ltd., Staverton Mills, Totnes.

Coventry.—Administration block, Holyhead Road, for the Water Department, and retail market; city architect, Bull Yard, off Warwick Row.

Daventry.—Houses (34), Badby, Braunston and Long Buckby; H. Bonsor, R.D.C. surveyor, Church Walk Offices.

Dundee.—Eight-storey flats (192), City Road re-development area; burgh surveyor.

Eastbourne.—Factory, Brampton Road; British Syphon Co., Ltd., Barnsbury Street, London, N.1.

Enfield.—Dwellings (146), Manor Farm estate; Townsend & Collins, Ltd., builders, 129, Goat Lane.

Gateshead.—Additions to Durham Road School (£100,000); borough engineer, Municipal Buildings.

Crematorium (£75,000); borough surveyor.

Glasgow.—Houses (416), Easterhouse; Architects' Department, Municipal Buildings, George Square.

Grantham.—Factory, Station Road; Newbond & Burton, Ltd., footwear, Welby Street.

Houses (50) in the Queensway-Canberra Crescent area; borough architect.

Hemel Hempstead.—Bank for Lloyds Bank, Ltd.; William Bignell (Builders), Ltd., Greystones, Croxley Green, Rickmansworth.

Honiton.—New wing at Marlpits Hospital; East Devon Hospitals Management Committee, Redhills House, St. Thomas, Exeter.

London.—Four- and six-storey blocks of flats, Osborne Road, Acton; borough engineer.

Flats (32) and studios (8), Limerston Street, Chelsea; H. T. Oliver & Sons, Ltd., builders, 371, Clapham Road, S.W.9.

Showrooms and offices, Duke Street, Westminster; J. Jarvis & Sons, Ltd., builders, 239, Vauxhall Bridge Road, S.W.1.

Factory in Park Royal Road, Acton, N.W.10; Middlesex Tool and Gauge Co., Ltd., toolmakers, etc., North Acton Road, N.W.10.

Manchester. — Conversion of Capitol Cinema, Parrs Wood Road, for use as television theatre and studios; Drury & Gomersall, architects, Roxey House, Oxford Road.

Margate.—Factory, Gordon Road, Westwood; G. A. Harvey & Co. (London), Ltd., Woolwich Road, London, S.E.7.

Three blocks of flats, Addiscombe Road; borough engineer.

Northumberland.—Special school at Guide Post (£60,000); R. Bowey & Son, Ltd., contractors, 34, Great North Road, Newcastle.

Norwich.—Three-storey offices on the Queen Street/Tombland site; Woolwich Equitable Building Society, Head Office, Equitable House, Woolwich, London, S.E.18.

Oxford.—Dwellings (276), Horspath estate; John Laing & Son, Ltd., builders, Bunns Lane, London, N.W.7.

Peterborough.—Second instalment of technical college (£80,000); Portess & Richardson, architects, Lloyds Bank Chambers.

Sheffield.—Newfield Secondary School for Girls; J. W. Sivil, Ltd., 39, Canterbury Avenue.

Shoreham-by-Sea. — Additional factory premises; F. G. Miles, Ltd., The Airport.

Southampton.—Factory, Redbridge Road; Moorgreen Metal Industries, Ltd., Grove Street.

Thornaby.—County modern school; county architect, County Hall, Northallerton.

Wakefield.—Showrooms at Austin House, Westgate; Turner & Holland, architects, 4, King Street.

Wallasey. — Houses (119), Moreton; borough architect, 142-148, Brighton Street.